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INDIANA UNIVERSITY BULLETIN

October
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SECOND ANNUAL CONFERENCE

ON

EDUCATIONAL MEASUREMENTS

Held under the Auspices of the

Extension Division of Indiana University

AT

BLOOMINGTON, INDIANA, FRIDAY AND
SATURDAY, APRIL 16 AND 17, 1915

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"These tests will not replace skill, they will not replace tact, they will not replace kindness, they will not replace enthusiasm, or nobility. On the other hand, they will not in any sense harm us, and they will be useful as helps, no matter how ideal our aims. Our ideals may be as lofty and subtle as you please, but if they are real ideals, they are ideals for achieving something; and if anything real is ever achieved it can be measured. Not perhaps now, and not perhaps in fifty years from now; but if a thing exists, it exists in some amount; and if it exists in some amount, it can be measured. I am suspicious of educational achievements which are so subtle and refined and spiritual that they cannot be measured. I fear that they do not exist."—E. L. THORNDIKE, in Proceedings of Indiana University Conference on Educational Measurements, 1914.

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SATURDAY AFTERNOON SESSION

Second Conference on Educational Measurements

FRIDAY MORNING SESSION

The conference was called to order by President Bryan, with the following words of welcome:

PRESIDENT BRYAN: Ladies and gentlemen, it is certainly a great pleasure for us to welcome you here for the Second Annual Conference on Educational Measurements. It is a fine thing to find the leading school men and school women of the State ready to meet together for the study of the problems with which they have to deal.

I do not believe that there is any profession whose members are more ready to examine again and again the foundation principles of their work, and to find out new and better ways of doing the things which are committed to their charge.

It has been a great satisfaction to me in these last years to serve as a member of the State Board of Education under the able leadership of the State Superintendent of Public Instruction, and I am especially happy this morning to introduce to you as your presiding officer Hon. Charles A. Greathouse, the Superintendent of Public Insuruction of Indiana.

ADDRESS OF PRESIDING OFFICER

MR. GREATHOUSE: Mr. President, ladies, and gentlemen, I consider it a distinct honor to be invited to preside at this meeting, and to introduce the distinguished speakers of this morning's session.

It is fitting that this meeting on educational measurements should be held under the auspices of our own State University. I am glad to see so many teachers, principals, and superintendents present. It assures me that you are interested in any progressive method which has for its purpose the betterment of our educational system.

I congratulate you also on being connected just at this time with the school work of Indiana, for at no period in the history of our educational system has there been more harmony in our affairs, and more substantial growth in our system than we have in Indiana today. In my report to the Governor of the State, which will be issued shortly, I have found that last year we had enrolled in the schools of Indiana more than five hundred thousand boys and girls, with an average attendance of more than four hundred and eleven thousand; and that these pupils were in charge of more than seventeen thousand educated and qualified teachers, who receive out of the public treasury of Indiana every year more than $7,000,000. In addition to this we have established in eighteen cities vocational centers with one hundred and seventy-five teachers and more than seventy-five hundred students, consisting of men and women, and boys and girls. At the next meeting of the State Board of Education, we will have approved eight vocational schools for instruction in agriculture with a full corps of teachers and a large enrollment of pupils.

What an admirable system we have! Our State is dotted thruout its length and breadth with district schools, high schools, colleges, and universities, all working to the same end. When we reflect upon the enormous amount of money now expended and upon the great army of men and women at the present time engaged in the school work in this State, we cannot but be surprised to remember that there ever was a time when there were no schools of this system in existence, and when a governor of one of the colonies could be moved to thank God we had no public schools in America. In the light of what has taken place since his day, we cannot but be surprised to find such an utterance in history. But we must remember that that was due to an old political idea. A new day has come. The old system of government of the Middle Ages had been to treat the people merely as serfs. The era of political freedom has changed all that. The great idea of popular education in the interest of free government has found its way into the hearts and minds of the people. It was the governor of the colony of Virginia who thanked God that there were no public schools in America, and he foolishly believed the less the people knew the easier they were to govern. But when the Mayflower landed at Plymouth a wiser voice determined the character of the government in that province; and it may be that the Pilgrims saw clearly even then the vital relation between education and government.

My friends, I have an abiding faith in the public school sys-

tem as a civilizing agency, as a preparation for the duties of citizenship. The uncomplaining contributions of the masses for its support shows an unselfish concern for future generations. It means to them not only the preservation of the republic now, but its perpetuation. To keep this sacred department of our government free from politics, divorced from graft and every other form of corruption, should be the firm resolve of every man connected with the school system of Indiana. The commercialism of the day should not be permitted to spread its influence over this most important department of government. The management of our schools should be with an eye single to the education of those upon whom the responsibility of government will soon rest. The subject of our public schools is one of commanding importance. It is nearest the heart, since it concerns every household in this State. In all the vicissitudes of politics, amid the bitterness of partisan strife, the management of our schools has ever commanded the love and veneration of our people; and whatever changes may hereafter take place in our form of government, whether by peaceful means or by force of arms, the people will never surrender free education.

Now, ladies and gentlemen, I apologize for taking so much time. We have this morning two distinguished speakers. The first gentleman on the program needs no introduction to an audience such as this. I regard him as one of the strongest men in the educational field. Ladies and gentlemen, Dean W. W. Black, of the Indiana University School of Education, who will address you on "The Movement for Greater Economy in Education".

THE MOVEMENT FOR GREATER ECONOMY IN EDUCATION

Mr. Black: The present movement in the study of Education seeks economy from four points of view, viz.: (1) economy thru the quality of the product, (2) economy in quantity of the product, (3) economy in time, and (4) economy in the expenditure of energy.

These four economies should move together, each in harmony with the others, and each, therefore, serving as a check on one or more of the others. For example, quality demands that the pupil be taught to write well, but quantity, time, and expenditure of energy demand that he does not write too well. Quantity and the writer's time demand that the pupil develop speed in writing,

but quality, demanded by the time and expenditure of energy of the reader, insists that he does not write too rapidly. In the matter of style, quality demands that the writing be most legible. This demand was, I think, the cause of our substituting, some years ago, the vertical system for the Spencerian slant. But vertical writing, while most easily or rapidly read, failed to satisfy the demands of quantity, or speed. The demand of speed alone would have carried us back to full slant, for full slant permits greatest speed. But the two factors of legibility and speed, working together, and checking each other, have caused, or are causing, medium slant to come to stay, as I think. And this adoption of medium slant must not be considered as a compromise, for compromise suggests a remaining opposition, an unsatisfactory settlement. It is rather to be considered as a resultant of the operating of two factors working in harmony.

In accordance with this principle of harmony of economies, a child should learn to spell well, but his spelling vocabulary should not be extended beyond what a reasonable expenditure of time and energy would give him. When fairly interpreted, the principle holds equally true in all the subjects. And it is coming to be applied in practice, as is shown in the present movement to lessen the number of topics to be treated in the different subjects, and in this and other ways to cut down the amount of time to be devoted in case of most of the subjects.

The present movement for a scientific study of economy in school education is basic in our attempt to solve the problem of the school. The purpose of the school is not that the child shall learn, for he would learn without the school. Its purpose is to furnish conditions under which the child, thru systematic and economic effort, will accomplish more for himself, and that what he accomplishes will be of better quality, and that the product will be secured to him in a shorter time and with less expenditure of energy, than if he learned under other conditions.

This problem of economy in school education breaks up, in practical study, into three problems: (1) the development, in so far as is possible, of accurate and usable means of measuring results and processes; (2) the bringing about of the most economic organization, and (3) the problem of method in learning and teaching.

It is becoming clear to us that our problem for first consideration (in order, not in time) is that of developing standards and measuring results. When fully considered much of the ground for the great waste in education is due, I think, to our lack of

adequate means for placing reliable estimates on our results and processes; we lack in the matter of a definite, desirable, and reachable goal to be sought thru a given topic, or process, or stage of the work in a given subject. We have been forced to work in a more or less blind, do-and-trust-to-luck sort of way. I need not enumerate the investigations that show how unreliable we have been in grading children's work. A single test will suffice to remind you. A year ago, in coöperation with Superintendent Smith, of the Bloomington schools, we had sixty-seven upper-grade pupils read the first chapter of Moores's *Abraham Lincoln*. Twenty-four hours later each pupil was asked to write from memory the main facts given in the chapter. The children's papers were graded by ten teachers of experience. Tabulation of the result shows variation, in part, as follows:

1. In no instance was there agreement in the markings. The lowest difference between the highest marking and the lowest in sixty-seven papers was 20 percent; the highest difference was 80 percent.
2. The median for the differences between lowest and highest markings in the sixty-seven papers was 45.

The present movement to develop standards for physical and mental tests, and for measuring tendencies, special abilities, and results, is a most significant attempt to meet the conditions that I have recalled to your minds. Sufficient progress has been made to guarantee great improvement to come. Yet I doubt if any one has more than a mere glimpse of the great progress that will be made in this line within the next forty or fifty years.

The beginning of this movement in Indiana is very encouraging. The sympathetic way in which the school men and women of the State have taken hold of the work while it is still in the experimental stage is highly commendable. I have heard just two objections given against the setting up of standards for measurement. One is that the test is objective, not subjective. This objection I have heard from three or four school men in Indiana altho one should not feel surprised or discouraged if it were widely urged at the present stage. The other is, that it will result in an attempt to develop all children alike; to run all thru the same mold, with the same outcome of product. I have heard this objection urged by a very few school men. The encouraging thing is that the great mass of educators in the State are approaching the question actively and open-mindedly. I know this to be true by the excel-

lent response we are receiving here in the School of Education in the matter of coöperative research.

Without going into argument, I may refer again very briefly to the two objections mentioned. First, in regard to the objective character of the tests now being used and further developed. That is just their claim to value; they are definite and tangible measures of definite and tangible results. The measuring unit must be as definite, as accurate, as objective as the result. The only way in which we can measure a man is thru what he does. That is the only way a man can really measure himself.

I grant that we cannot subject all of human life to mathematically accurate tests; certainly not in the near future. I agree, too, that human life is deeper than all our mathematics. Nevertheless, man's life is full of mathematics. He was mathematical before he became very spiritual. His mathematical self made the higher spiritual self possible. Just so this accuracy in objective terms will lead us to a clearer and more definite estimate of any classes of results which we may not be able to subject to definite objective standards.

As to the tendency to seek uniform results, the effect is meant to be, and is proving to be, just the opposite of uniform. Our surveys are giving us a knowledge of the conditions, both in school and out of school, under which the individual child lives. Physical and mental tests will tell us more accurately than we have been able to know heretofore the ability of each individual. The classroom tests will show us still more definitely the actual results and possibility of the individual child. With this accurate knowledge of the ability of the individual child, there is no way open but to make his self-furnished standards the guide in his case.

The principle of economy when applied to the individual child presents the second problem I have mentioned—that of organization of the school itself. The method of solution is simple. The principle is that the organization must be such that *each child shall have opportunity for being at his best all the time in all the subjects.* The school by this principle must be organized, in so far as possible, to permit *individual promotion by subjects.*

The problem of organization of subject-matter into the course of study is more difficult on account of the difficulty in securing agreement in determining educational values, and in selecting material. Yet good progress is being made. We must find some way by which we can, in general, reduce the time devoted to the different subjects. This can be done as rapidly as we come to

see (1) that a child need not recite in class, or learn in school, all the facts that he will need to use in later life, and (2) that a subject can usually be organized about a very few principles and organically related topics.

The greatest progress will come, in my judgment, with our advance in our knowledge of method, using the term method in the sense of mental movement. So far we have relied mainly on imitation and trial-and-error. Both are good, but not sufficiently economic. We must find, much more accurately than we now know, how children learn; the nature of the process and the conditions most favorable for the process. We already know a few general principles sufficiently well for use in experimental work. Our problem in method has therefore reached the state, as it seems to me, of experiment under guidance of psychological principles.

If we set up a certain standard based upon what certain groups of children can do, that standard is open to question from the points of view of economy, organization, and method. Because of the inter-relation of these different factors in determining efficiency, such questions as the following arise: Does the standard demand too much or too little in time and energy? Could the individual, under different organization and method, meet the requirement of the standard more economically? Could he, under a different method, raise the standard with the same expenditure of time and energy? Is it desirable to raise the standard? Is the method such that the pupil has developed a sufficient degree of ability in applying the knowledge indicated by the standard? To what extent does the particular standard indicate future ability of the individual who has met it? In like manner definite standards are required in determining and checking the applications of the principles of method.

The three problems of standard tests, organization, and method are organically related. It would be a great error to attempt to solve any one of the problems independently of the others. Each must suggest the other two, and each must serve to check and guide the others.

These problems cannot be best handled individually. It is not a matter for the man in the School of Education to solve in his study of classroom, or the superintendent or supervisor in his office. The further work on principles must be done thru practical application. The schools of education need the coöperation of the public schools, and just as much, I think, the public schools need the coöperation of the schools of education. This reciprocal value I

need not discuss here, as it will be taken up in a later discussion of the conference.

I may say in closing that this conference, with the single set purpose of the members, gives us all the encouragement in the way of coöperative spirit that men in schools of education could ask. We are glad to welcome you!

MR. GREATHOUSE: It will be necessary, ladies and gentlemen, to change the order of the program from the one printed. We have just had a telephone message from Mr. Courtis saying that he has missed his train at Indianapolis and it is impossible for him to reach Bloomington before the afternoon session; so it will be necessary to take up part of the afternoon work at this time. I am pleased to announce the subject on the program for 3:30 this afternoon, as a Symposium on Coöperative Research. Superintendent O. C. Pratt of the Wabash public schools will now speak to you on "The Value of Coöperative Research".

THE VALUE OF COÖPERATIVE RESEARCH.

MR. PRATT: In arranging to discuss the value of coöperative research from the superintendent's point of view, Superintendent Stopher and I did a little coöperative planning. It was decided that I should introduce the subject in a general way, limiting myself to impressions gathered from coöperative work, while he would discuss in detail the results of one such study.

In an article under the caption, "A Fairyland of Science", in the February number of the *National Geographic Magazine,* I ran across a sentence which seems to me to be very pertinent for the purpose we have in view in this conference. The sentence reads as follows: "Just as James Watt could not make a steam engine until men were able to take measurements so exact that a cylinder and a piston could be built which were steam-tight and yet allowed free play, so the perfect automobile of today had to wait until men could measure the five-thousandth part of an inch, and the perfect ship's chronometer until they could measure distance five times more minute than that." For every expert worker, whether of hand or brain, a certain degree of accuracy in measurement is indispensable. I once knew a carpenter whose work was seldom satisfactory because he seemed to realize the existence of only one unit of measure less in length than the inch. If "Uncle Dick", as we called him, had to measure a board to fit an opening, he usually announced the needed length as so many inches and a

"smidgin" over. Uncle Dick was an honest, sober, industrious workman, but he was largely a failure as a carpenter because his unit of measure, the "smidgin", lacked that degree of accuracy essential to successful work in his chosen trade.

It seems to me that the source of Uncle Dick's weakness as a carpenter is also the source of much of our weakness as teachers. We, too, measure entirely too freely by "smidgins", and because we are working with products less tangible than door frames, we are all too often unaware of the extent to which our work fails to fit.

Herein appears the value of the new educational scales and of coöperative research. One of the things brought out most prominently by the educational scales is the extreme range of variations among pupils of the same grade in any line of work. The scales also make clear that the work of teachers is equally variable. Superintendents commonly classify teachers as "superior", "strong", "fair", etc. As a matter of fact, there are few if any teachers who are uniformly strong in teaching the various subjects of the curriculum. Some years ago I had each of the teachers then under my supervision indicate the subject which she liked best to teach and that which she liked least. I then had her average the grades which she had given her pupils in their various studies for the year, and with scarcely an exception the teachers were surprised to find that they were teaching best what they liked best, and worst what they liked least.

There is every reason to believe that superintendents are as variable in the strength of their work as are pupils and teachers. The teachers in a school system soon detect the superintendent's hobby, and whether consciously or not, will consider important what he most emphasizes. Coöperative research enables the superintendent to get a line on his school system which will reveal the directions in which it is strong and those in which it is weak. It enables him to substitute a certain degree of scientific precision and accuracy in viewing the school system which he supervises in place of the more or less hazy, indefinite impressions, the guesswork "smidgins", to which he is otherwise limited.

Coöperative research, by pointing out the weak places in a system of schools, shows the teachers and superintendent the proper point of attack. It discloses certain problems of abnormality and asymmetry, the very existence of which was previously unknown to the school authorities. It undoubtedly raises problems of all kinds, tho solutions for them may not be forthcoming.

Coöperative research arouses in the entire teaching corps a deeper interest in education as a profession and a stronger incentive to look at school work in a professional manner. Most of us here, I presume, have at one time or another taken correspondence courses. Such courses are more difficult than those pursued under classroom instruction chiefly because the incentive toward effort which one gets from association with his fellows in the classroom is lacking in correspondence work. One is thrown upon his own resources and must work alone. Without coöperative research the teacher is similarly isolated. She has no sure means at hand for judging in detail the quality of her work. Those who supervise her work are more or less noncommittal, partly because their opinions are not definite and clearcut, and partly because, being mere opinions, they cannot be substantiated by conclusive proof. Coöperative research offers impartial and impersonal evidence which cannot be gainsaid. If the superintendent finds his previous opinion confirmed, he can then confer with the teacher with more confidence that his views are sound. If the teacher finds a weakness in some unsuspected place, the greater attention which she will give that phase of her work will tend to cure the defect without specific comment by the superintendent. If both superintendent and teacher find their school system distinctly below the general level in any respect, they set themselves whole-heartedly to the task of bringing it up to grade.

The educational scales in conjunction with coöperative research give a better opportunity to mark progress made. This in itself furnishes one of the strongest possible incentives for energetic work. We all like to see the chips fly. Every one likes to have assurance that extra energy expended will bring measurable results in extra progress made. One of the greatest drawbacks to teaching as a profession has been our inability to measure the results of our teaching. To the average school patron, teachers are like what the Irishman said of men, "One is just as good as another", except that the Irishman added, "if not better". We are even yet unable to discriminate sufficiently in favor of the better teachers. Evidence of this fact may be found in the too nearly uniform success grades which we give our teachers. Probably nine-tenths of the city teachers in Indiana are rated at or above ninety percent in success. In view of this, is it at all likely that we are measuring our teachers accurately or fairly?

Coöperative research benefits the pupil by enabling him to compete not so much with his stronger or weaker fellows as with him-

self. It gives him and his parents a definite measure of his progress, and an accurate notion of his relative class standing in the particular phase of the subject measured. That the scales we now have are imperfect none will deny. That no scales yet devised will measure any school subject from every angle is undoubtedly true. But it is equally certain that the gain in accuracy of measurement will eventually bring about such a reconstruction of educational machinery that we may ultimately hope to attain to a perfection approaching that of the automobile engine, or the ship's chronometer.

Mr. Greathouse: The subject will be further discussed by Superintendent E. C. Stopher, of the Noblesville city schools.

A CONCRETE CASE OF COÖPERATIVE RESEARCH

Mr. Stopher: Ladies and gentlemen, my particular task is to discuss in a very brief way a concrete case of coöperative research and give the benefits of that particular research to our teachers.

During the year 1911-12, the Northern Indiana Superintendents' Club made a study of retardation in the schools which they represented. In particular the report was for the first semester of that year. Each superintendent embodied in his report the total enrollment, an age-grade distribution of children for the eight grades, the total failures, percent of failures, a brief study of the causes of the failures, and the main subjects in which the pupils failed. Superintendent Deamer of Laporte organized and tabulated the results from the various schools.

The percent of failures for this term ranged from 6.1 percent of all pupils in one city to 20.6 percent of all in another, or from 5 percent of the girls in one place to 22.7 percent of the boys in another. In each of the fifteen cities studied, the percent of failures among the boys was larger than that among the girls. The chief subjects in which pupils failed were reading and arithmetic.

This report was followed by another which undertook a more careful and detailed study of the amount of and the causes of retardation. We in Noblesville had not made any accurate measurement of our retardation but believed there was less in Noblesville than in many other towns. We had been strengthened in this belief by visiting other schools and concluding that the pupils in our upper grades appeared younger than those in others. Many of our teachers wished that we might have fewer failures but

justified in a way our number because of the belief that we had fewer than others.

This coöperative study was made during the fall of 1912. The causes of retardation were listed as (1) mental defects; (2) physical defects; (3) sickness; (4) truancy; (5) poor home life; (6) late start; (7) laziness; (8) overwork; (9) changes of schools; (10) irregular attendance; (11) poor teaching; (12) timidity; (13) other causes. Superintendent Hines of Crawfordsville did most of the work in organizing and tabulating the results of this investigation.

Ayres' method of determining who were retarded was used and then each teacher was asked to give as best she could the cause of the retardation. If there were in any case several causes the one the teacher considered the most important was assigned. The investigation as to causes was scientific only in that it recorded accurately the best judgment of the teacher.

TABLE I. CAUSES OF RETARDATION IN TWENTY INDIANA CITIES

CAUSES.		City 1.	City 2.	City 3.	City 4.	City 5.	City 6.	City 7.	City 8.	City 9.	City 10.	City 11.	City 12.	City 13.	City 14.	City 15.	City 16.	City 17.	City 18.	City 19.	City 20.	Totals.		Percent of Enrollment.
Mentally defective	Boys	3	38	11	17	0	19	16	50	13	12	8	3	11	6	36	7	13	10	14	15	302	540	2.3
	Girls	5	36	11	14	1	17	8	32	7	8	9	0	5	4	23	11	23	4	5	15	238		
Physically defective	Boys	7	17	17	5	4	9	12	17	12	5	5	1	11	5	5	8	7	1	3	6	157	284	1.2
	Girls	6	11	20	6	2	6	3	17	3	5	3	2	7	7	0	9	14	1	0	5	127		
Sickness	Boys	13	32	6	7	2	16	7	15	3	7	12	11	8	5	10	6	2	2	1	2	167	320	1.3
	Girls	7	28	4	10	1	10	2	18	8	5	8	11	7	9	7	6	4	3	3	2	153		
Truancy	Boys	0	5	5	1	0	1	0	5	1	2	0	0	0	3	1	2	1	0	1	0	28	36	.15
	Girls	0	0	2	1	0	0	0	1	0	0	0	0	0	3	1	0	0	0	0	0	8		
Poor home life	Boys	8	28	7	8	10	24	17	12	16	17	13	5	5	15	10	12	8	3	9	7	234	384	1.6
	Girls	9	115	1	10	3	12	5	9	5	13	10	0	0	15	5	15	7	3	7	6	150		
Late start	Boys	5	12	4	7	0	10	1	21	1	4	0	0	42	12	2	2	2	2	2	0	129	245	1.
	Girls	3	14	5	7	0	7	0	21	1	5	2	1	23	11	5	4	1	2	3	1	116		
Laziness	Boys	3	30	6	4	5	22	10	31	21	26	47	8	15	6	6	12	4	2	13	2	273	342	1.4
	Girls	3	8	6	0	1	3	1	3	2	3	16	8	5	2	3	0	3	0	0	2	69		
Overworked	Boys	0	0	5	0	0	2	1	0	0	1	0	0	0	1	0	0	0	0	1	0	11	24	.1
	Girls	0	0	5	0	0	1	0	0	0	2	0	0	0	5	0	0	0	0	0	0	13		
Change of schools	Boys	5	27	2	8	4	15	7	28	24	15	14	1	56	7	12	8	0	4	3	7	247	438	1.8
	Girls	13	26	2	8	3	11	6	22	10	9	13	1	34	8	5	7	0	3	3	7	191		
Irregular attendance	Boys	3	20	5	5	0	10	4	34	0	7	2	12	17	11	4	4	6	2	7	2	155	280	1.1
	Girls	3	19	2	3	0	10	0	23	0	10	2	4	14	6	7	8	5	0	8	1	125		
Poor teaching	Boys	0	1	1	1	0	1	5	1	0	1	0	1	0	1	1	1	0	0	0	0	15	24	.1
	Girls	0	0	1	0	0	1	0	1	0	0	0	1	1	2	2	0	0	0	0	0	9		
Timidity	Boys	2	1	0	1	0	3	3	0	0	0	0	0	2	1	3	1	0	0	2	1	20	55	.2
	Girls	1	4	0	3	1	2	1	0	0	2	0	0	0	7	3	4	0	1	4	2	35		
Other causes	Boys	11	8	10	2	4	12	5	124	0	11	0	15	33	8	0	4	8	0	6	0	261	451	2.
	Girls	10	9	11	0	0	3	0	98	3	14	0	6	15	4	0	4	12	0	1	0	190		
Total retarded	Boys	60	219	79	66	29	144	88	338	91	108	101	57	200	81	90	67	51	26	62	42	1999	.....	
	Girls	60	170	70	62	12	83	26	245	39	76	63	34	111	83	61	68	69	17	34	41	1424	.....	
	Total	120	389	149	128	41	227	114	583	130	184	164	91	311	164	151	135	120	43	96	83	3423	.....	
Total enrollment		650	3566	763	870	475	1308	707	2379	1530	1053	652	1242	2013	1176	759	575	1190	591	1361	694	23,253	.....	
Percent of children retarded		18.5	10.9	19.5	14.7	8.6	17.3	16.1	24.5	8.5	17.5	25.1	7.3	15.4	14.	19.9	23.5	10.1	7.3-	7.	12.	14.7	.....	
Rank of school system		15	7	16	10	5	13	12	19	4	14	20	3	11	9	17	18	6	2	1	8	.....	.....	

The accompanying table (Table I) shows the result of the investigation. Twenty schools were studied and the numbers at the top refer to these different schools. They were Alexandria, Anderson, Auburn, Bluffton, Columbia City, Crawfordsville, Decatur, East Chicago, Frankfort, Hartford City, Kendallville, Laporte,

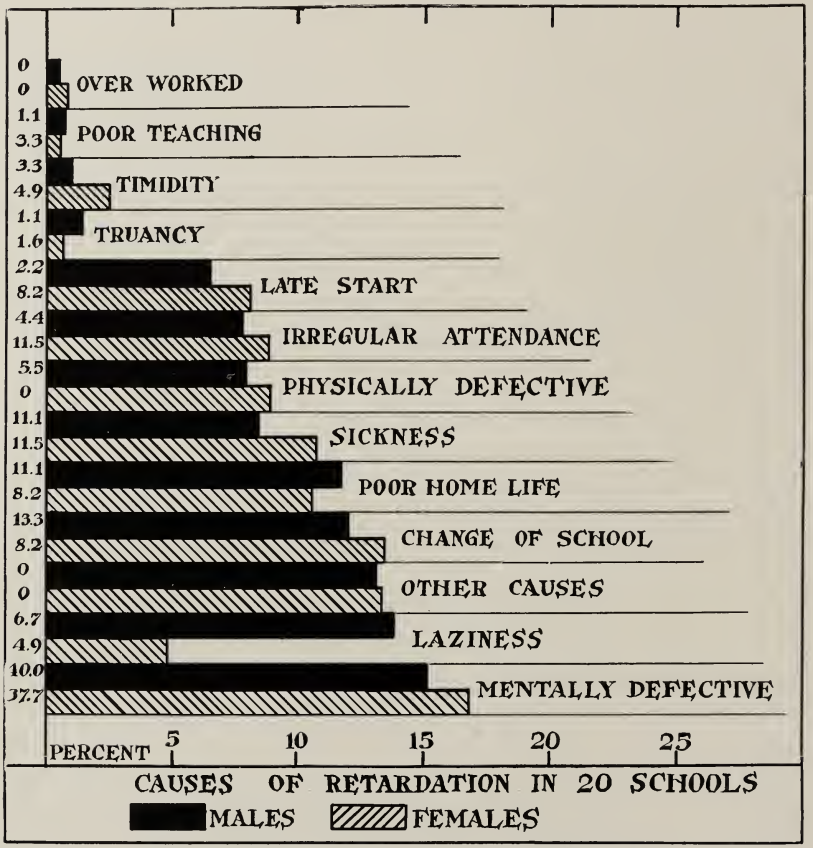

FIG 1. CAUSES OF RETARDATION IN TWENTY INDIANA CITIES, 1911-12

Michigan City, Mount Vernon, Noblesville, Plymouth, Princeton, Rochester, Wabash, and Warsaw. Noblesville was number 15. The total number of pupils in these schools was 23,253; the number retarded was a little more than 3,400, of whom practically 2,000 were boys and 1,400 were girls. It could easily be seen that the number of girls retarded was only about two-thirds of the number of boys. In Noblesville there were 61 girls and 90 boys, a total of 151, who were in most cases two or more years too old for their grades.

The percent of retardation ranged from Wabash with 7 percent to one of the schools with 25.1 percent. Noblesville stood number 17 with 19.8 percent.

The column marked "Totals" indicates the number of boys and girls retarded for the various causes. Thus we find that 302 boys and 238 girls were said to be mentally defective; 157 boys and 127 girls physically defective. The ratio of boys and girls changes for the various causes. More than three times as many boys as girls were said to be retarded because of truancy and laziness, while in only two cases were there more girls than boys,—those retarded because of overwork and those because of timidity. The percent of retardation for each city is indicated on the chart and the rank of each system among the twenty is shown on the bottom line of the chart.

Figure 1 shows more plainly the comparative number of boys and girls retarded for the various causes.

The percent of the total number of boys retarded because of overwork is indicated by the length of the solid line, 0.5 percent; the percent of girls retarded for this reason was .9 percent and is indicated by the length of the crossed line. The causes are arranged in order of the percent of the boys retarded. It is interesting to note that "laziness" is assigned as the cause of failure among boys nearly three times as often as among the girls. It should be borne in mind that these causes were the estimates of the teachers and not determined by any kind of test.

Altho there were more boys than girls retarded for nearly every cause, yet it was seen that only in three causes, namely, truancy, poor home life, and laziness, was the percent of boys retarded larger than that of the girls. With the exception of "poor home life" these were causes over which the child could exercise some control. There were eight causes in which the percent of girls retarded was larger than that of the boys, and these were causes over which the child had little or no control.

Now of what value to Noblesville teachers was this particular coöperative study? In the first place it indicated definitely that there was actually a large amount of retardation because we stood number 17 in a group of 20. Some definite information as to the actual conditions was now available and definite information as to conditions is essential to improvement. Of course the fact that we stood so near the top or bottom was not conclusive proof that conditions were not what they should be, but in this case teachers without exception interpreted the figures to mean that in some way

we must reduce the waste caused by retardation and move considerably closer to Wabash. In the second place, then, *this research work did more than years of study and theorizing to make each teacher realize the importance of the question, enter heartily into further study of it, and endeavor to make improvement.*

The fact that Noblesville would in all probability at some future period again be measured along with other schools gave enthusiasm to the work at hand.

TABLE II. RETARDED CHILDREN IN THE NOBLESVILLE SCHOOLS

GRADE.	Total Enrollment by Grades.			Percent of Children Retarded.			Rank of Grade in Retardation.		
	1912	1913	1914	1912	1913	1914	1912	1913	1914
First	131	131	122	12.2	13.7	3.3	2	2	1
Second	98	113	108	17.3	11.5	15.7	3	1	3
Third	88	99	117	21.6	15.1	15.4	4	3	2
Fourth	118	94	98	28.8	21.3	16.3	7	4	4
Fifth	94	101	85	31.9	26.7	22.4	8	8	6
Sixth	76	91	100	23.7	26.4	29.0	6	7	8
Seventh	75	86	90	22.7	25.6	24.4	5	6	7
Eighth	80	61	82	10.0	21.3	19.5	1	5	5
Total	760	776	802	21.2	19.6	17.6	.....	.....	.....

A study of the causes assigned for retardation encouraged a number of teachers to be more actively interested in child study. Were boys so much lazier than girls? Was this characteristic prominent in other lines of activity? Why did girls seem to adapt themselves more readily to the routine of the school? How may the teacher make the school work appeal to the boy who is apparently lazy? What may the teacher do to eliminate a number of the causes of failure? Of what value is it to a mentally deficient child to repeat a grade? These were some of the questions asked and the fact that other schools were interested in these same problems was an incentive to careful study and action.

The doubts raised in the minds of the teachers as to the legitimacy of some of the causes assigned for failures has aroused more interest in the individual child. This has caused a decrease in the number of failures and, I believe, has at the same time resulted in a lower percent of variability in the different classes.

In summing up the results of this research work, the following facts may be given:

1. Definite information was secured concerning the relative standing of our school among nineteen others, the first thing necessary for improvement.

2. The problem was brought home to teachers and made real to them more definitely than could have been possible in any other way.

3. The knowledge that others were interested in the same problem aroused interest and enthusiasm, and seemed to give dignity to the question.

4. Teachers took a more professional attitude toward the question of retardation.

5. Teachers became more interested in child study, in the subject of individual differences, and in the welfare of each individual child.

6. Teachers concluded that since there were so many more failures among the boys than the girls, our course of study was probably like that of a number of others better adapted to the abilities of girls than to those of boys.

7. The benefit to the teacher can best be measured by noting the results of the investigation. Table II shows the enrollment in each grade for the years 1912, 1913, and 1914, the percent of retardation, and the rank of each grade. Thus we may see that the total retardation has decreased to 17.6 percent, and whereas in 1912 the most retardation was in the 4th and 5th grade, now it is in the 6th and 7th. This is as it should be and is perhaps the best indication of the value of the investigation.

Mr. Greathouse: M. E. Haggerty, Associate Professor of Psychology here at the University, will give the closing address on this topic.

COÖPERATIVE RESEARCH FROM THE VIEWPOINT OF THE UNIVERSITY

Mr. Haggerty: It is my purpose to discuss the matter of cooperative research from the viewpoint of the University. In doing so I shall confine myself chiefly to that aspect of our program with which I personally am most concerned. I hope the spirit of my remarks will represent the interests of other members of the faculty who are interested in other phases of this matter.

In the present contact of the science of psychology with education, interest centers about two problems, the measurement of mental ability as an individual quality and the measurement of school products. In both fields the most striking achievement has been the establishment of standard norms with which individual

measurement can be compared. For the measurement of mental ability we have the Binet scale with its various revisions and extensions. For the measurement of school achievement we have the Thorndike, Ayres, and Freeman scales for handwriting, the Buckingham spelling scale, the Thorndike and Courtis scales for reading, the Courtis, Hillegas, and Harvard-Newton scales for English composition, the Courtis standard tests for fundamentals in arithmetic, and others not so well known as these. Both in the measurement of general mental ability and the measurement of school products there is evident a vigorous tendency to press on from the first crude and tentative standards to more refined and accurate means of measurement. Binet twice revised his own scale, Goddard revised it in 1911, and we are now about to have the Stanford Revision, the work of Terman and his students, and Yerkes and Bridges have in press a book describing a "point scale" method which, it is thought, will be a great improvement over any previous scale. It is quite improbable that we shall have reached the end with the publications of these scales. Better adapted tests, more accurate methods of grading, more clearly defined norms are the goals toward which we are moving.

The same movement is apparent in the standards of school achievement. From the first handwriting scale of Thorndike, crude and tentative as its author admits it to be, we have a succession of steps to new subjects and to revisions of the earlier scales. Work is only well begun in this field. The next decade is certain to see a very wide-spread interest among students of education in standard tests and they will be widely used by school men.

The significant thing about these standard tests and standard norms of achievement is that they have given us for the first time in the history of education one of the indispensable instruments of scientific study. They provide us with a dependable objective instrument for measuring the results of educational procedure.

One can realize the importance of this best by thinking what similar instruments have done for other sciences. There was doubtless a time when there were no standard measures of any sort. There was no science then, neither was there any mechanical or ornamental art, nor any stable and general commerce. Many of the words which still serve to designate legal units of quantity bear witness to a commonplace origin. Foot, pace, pound, fathom, grain, yard, are some of these. Doubtless all of these measures of length at first were subject to great variability in actual use, a variability as great as we experience in the use of the Thorndike

writing scale, greater than we get with the Courtis tests in arithmetic. It has taken a very long time to refine these units and to develop others as the need for them has arisen. Today many of these standards are legalized units in all civilized countries, and both commerce and science are dependent thereon. Our own government maintains a Bureau of Standards at Washington with exact standard units for all measures of mass, length, and time, with a large number of derived units.

For all current work in physical science these standard units are essential and without them modern physics or modern chemistry could not exist. Every student in these sciences must learn about them. Every new discovery or invention in science must be stated in terms of them; and every physical and commercial enterprise of modern civilization is absolutely dependent upon them. It is not surprising that a physicist, with his highly refined instrument of physical measurement, should look doubtfully upon the, as yet, immature efforts at measuring mental qualities and mental achievement.

What has already been done for physical science and to a lesser degree for biological science must be done to some degree for psychology, sociology, and economics if education is to achieve a standing alongside medicine and engineering as a program of scientific endeavor. We are yet a long way behind these older applications of science, but it means a great deal to our future that students of education and school men are becoming sensitive to the fundamental scientific need of standards of measurement.

One of the first things which the establishment of standard norms will do for the science of education will be to make definite and specific the aims of teaching. We have a bountiful supply of general aims, all of which have greater or less value. Education is to prepare for life; it is to train for citizenship; it is to make cultured men; it is to prepare for vocations; it is to develop power; it is to teach children to read and write. It is easy to agree with such aims, but they are of limited value to a teacher in the concrete tasks of the schoolroom. Where one confronts a particular boy with a particular task, like adding ten-figure columns, such aims as life, citizenship, culture, and power seem remote and ineffectual. It is safe to say no teacher really thinks of them. What one does think of is the particular boy and the particular problem and the time being spent and the quality of the work being done. But in these concrete matters one is greatly handicapped because just what a twelve-year-old boy in the seventh grade should

do in ten-figure column addition has been until recently very much a matter of opinion, and usually of conflicting opinion. All would agree that a boy at twelve should add better than at ten, but until recently we have had no definite objective standards as to what he should do at any age. In the absence of such a definite objective standard we have had all sorts of individual standards. Teachers in the same school, with similar children under similar conditions, have expected different achievement; at times standards have been established for a school and even for a city. With the progress of standards we shall be able to know what the average child at any age should do, what the best child will do, what the poorest child will do, and what percent of children will be able to make a particular score.

By the use of the Courtis standard tests in Indiana cities last year, we were able to show the median achievements of nearly nine thousand children. It was possible to determine a standard for each of four grades. The median scores for the several grades were as follows:

TABLE III. MEDIAN SCORES IN ARITHMETIC IN TWENTY INDIANA CITIES[1]

GRADE	Addition		Subtraction		Multiplication		Division	
	At.	R.	At.	R.	At.	R.	At.	R.
Grade 5	6.6	3.6	7.3	5.0	6.3	3.9	4.5	2.6
Grade 6	7.4	4.4	8.9	6.5	7.6	5.1	5.7	4.8
Grade 7	8.0	5.0	10.1	7.8	8.6	5.9	8.5	6.7
Grade 8	9.0	5.8	11.2	8.9	10.2	7.3	10.6	9.0

[1] *Indiana University Studies*, No. 27, "Arithmetic: A Coöperative Study in Educational Measurements." By M. E. Haggerty.

These facts are represented on a set of charts which I will show you here. This particular chart (Fig. 2) is called the Indiana Standard.

In this figure the individual medians of the 8,712 children reported by the twenty cities are represented by short horizontal lines across the sheet so drawn as to appear at midsection of the vertical dimension. This line is called the Indiana Standard. Each vertical line represents the scale for the test in question. The first, third, fifth, etc., lines represent the number of problems

attempted in the several tests in the several grades. The second, fourth, sixth, etc., lines in a corresponding manner scale the examples right. The portion of each line below the Indiana Standard is proportional to the difference between the zero and the median score. It is accordingly scaled into the proportional number of parts. The part of the line above the Indiana Standard is similarly scaled. Each vertical line is therefore a different scale from every other vertical line, since the median is different in every case.

It is possible on this form to graph the results from a class, school, or city, and to see quickly its relative standing. To do

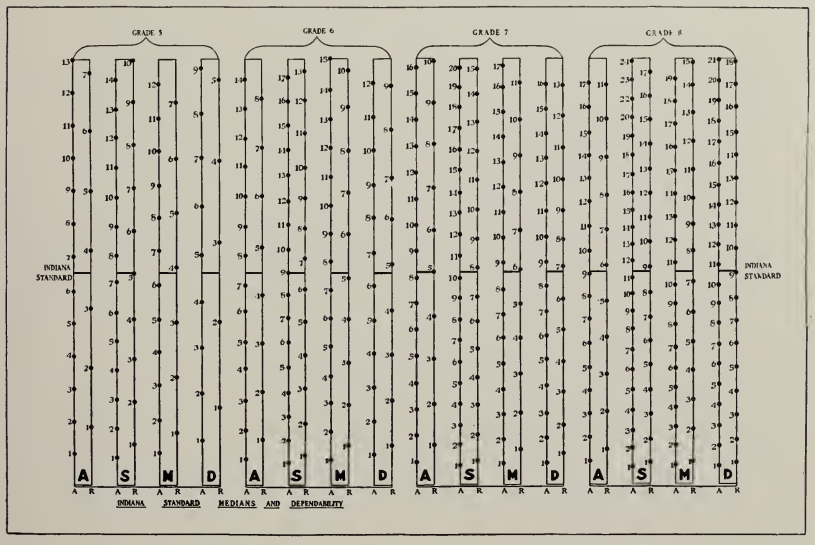

FIG. 2. INDIANA STANDARD: MEDIANS AND DEPENDABILITY IN ARITHMETIC

this you locate the proper score on its appropriate vertical line. If you join the points so located on the attempts scaled by a solid line with the similar point on the rights scale, you have represented the dependability of the work. If the line so drawn is parallel to the Indiana Standard, the percent of dependability is the same as the Indiana Standard. If the line slants upward to the right, the dependability is greater; if the line slants downward to the right, the dependability is less.

You may take exception to saying that what the average of nine thousand children do in Indiana should be called the Indiana Standard. Possibly it is not a very good name. Possibly it would have been better, for instance, if instead of taking the average of

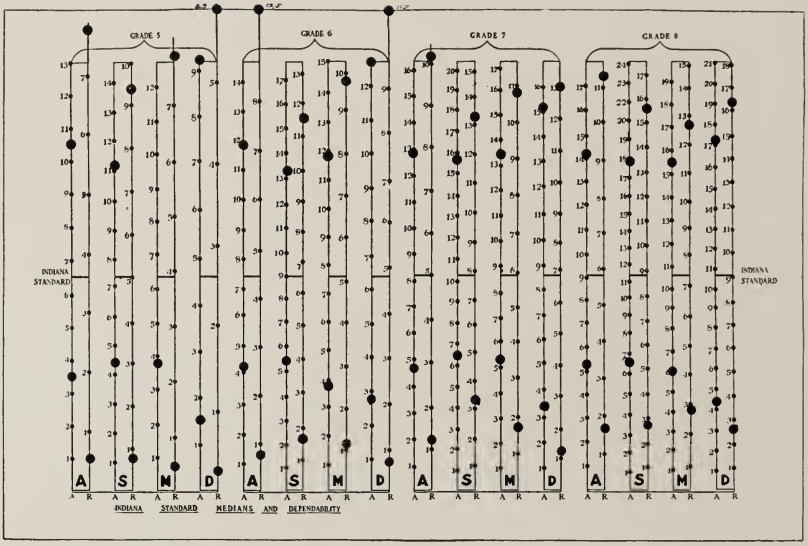

FIG. 3. MEDIAN SCORES OF BEST AND POOREST TEN PERCENTS IN ARITHMETIC OF 8,712 INDIANA CHILDREN

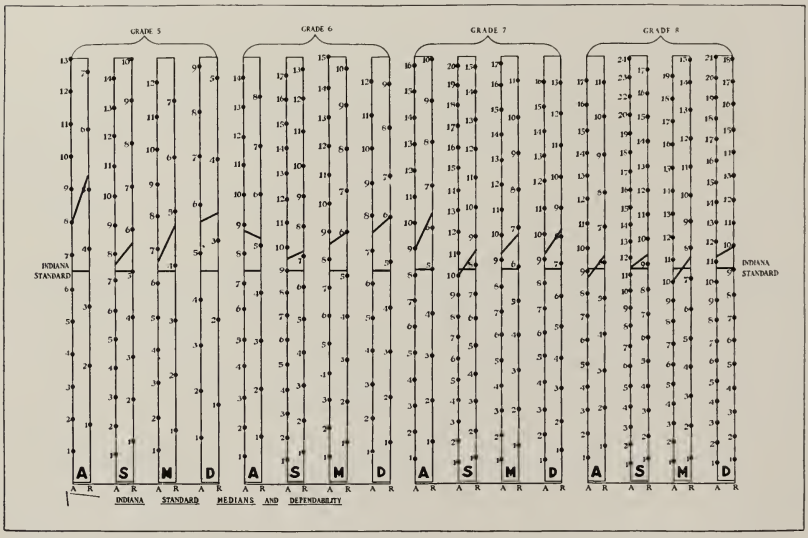

FIG. 4. MEDIAN SCORES IN ARITHMETIC IN ANDERSON (IND.) PUBLIC SCHOOLS (MAY, 1914)

these nine thousand children as the Indiana Standard we should have taken the best ten percent, the ones represented by the large dots at the top of this chart (Fig. 3).

These stand very much above the median of the whole group. The dots placed near the bottom indicate the medians for the poorest ten percent of the nine thousand children. It makes a very interesting picture. Here you see and realize that in the same grade you have ten percent of the children who make the score represented by the large dots near the bottom of Figure 3 (indicating), and you have another ten percent of children who make the score represented by the large dots near the top of Figure 3.

I will show you what you can do with this chart,—one thing you can do with it, at any rate. Figure 4 represents the results from the Anderson public schools,[2] more than a thousand children in the four upper grades. The median scores are graphed in relation to the Indiana average. If Anderson had been just the average city its lines would have fallen exactly at the points marked by the horizontal lines. You see Anderson did better than the average in fifth-grade addition attempts, and did very much better than the average in fifth-grade addition rights. The direction of these lines is significant all the way across. If a line is parallel to the Indiana median, the dependability, that is, the relation between the problems attempted and the problems accurately solved, is the same as the Indiana average. If the line slants upward the dependability is greater than the Indiana average. If it slants downward the dependability is less than the Indiana average. So that any city can by the use of the chart be very readily placed. You can very quickly tell whether it is better or worse, or just alike.

This chart (Fig. 5) represents the Bloomington[3] returns for last year. In fifth-grade division, you see a very marked superiority, but at some points it is not so marked. There is one case where the dependability is just the same; there are other cases where it is less; so that you get a check on both the median score and on the dependability of the work.

Figure 6 represents the facts in a similar way for the Courtis general scale, the one announced in February, 1914.

Figure 7 represents the same facts for the Boston schools.

Figure 8 represents the facts for the Detroit schools.

[2] *Indiana University Studies*, No. 27.
[3] *Indiana University Studies*, No. 27.

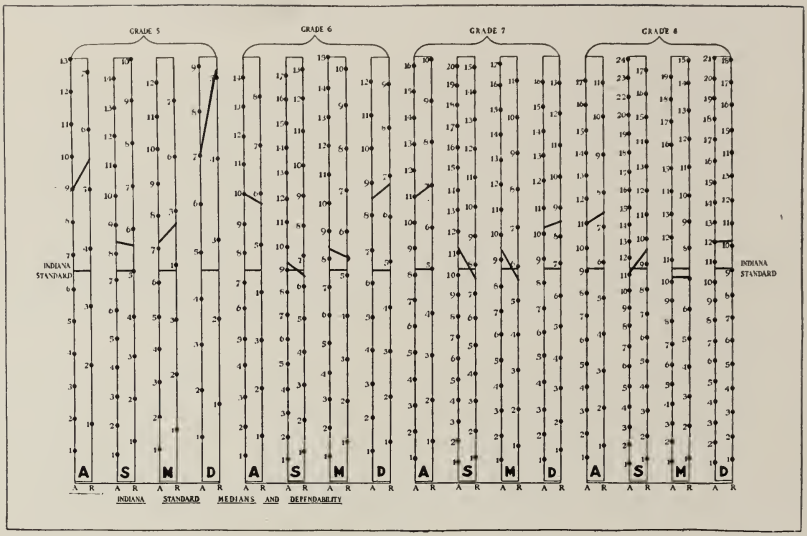

FIG. 5. MEDIAN SCORES IN ARITHMETIC IN BLOOMINGTON (IND.) PUBLIC SCHOOLS (MAY, 1914)

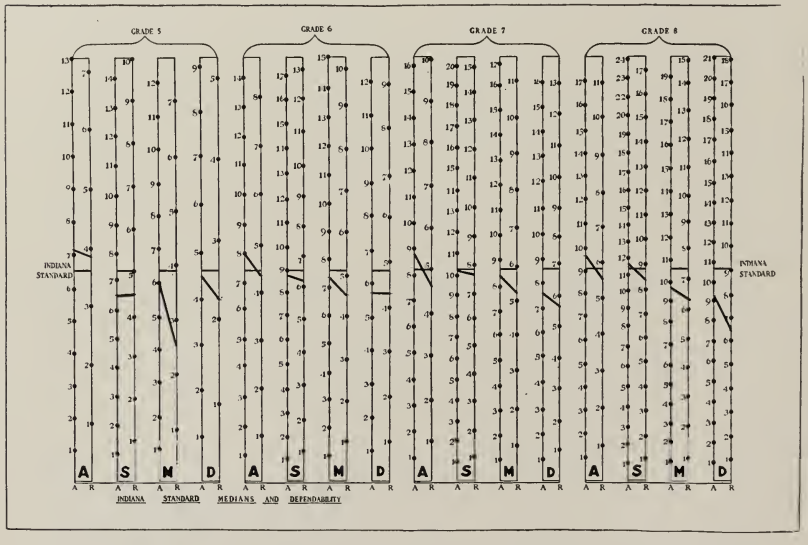

FIG. 6. MEDIAN SCORES IN ARITHMETIC: COURTIS GENERAL SCORE (FEB., 1914)

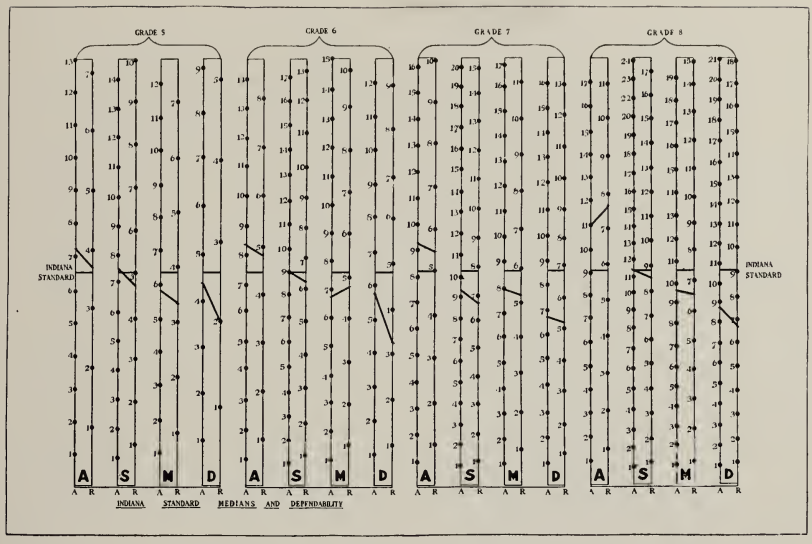

FIG. 7. MEDIAN SCORES IN ARITHMETIC IN BOSTON PUBLIC SCHOOLS (FEB., 1914)

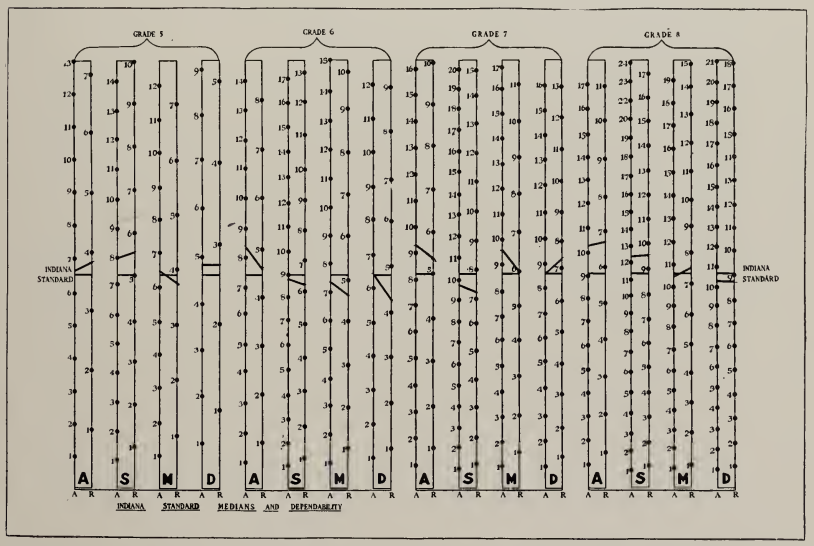

FIG. 8. MEDIAN SCORES IN ARITHMETIC IN DETROIT PUBLIC SCHOOLS (FEB., 1914)

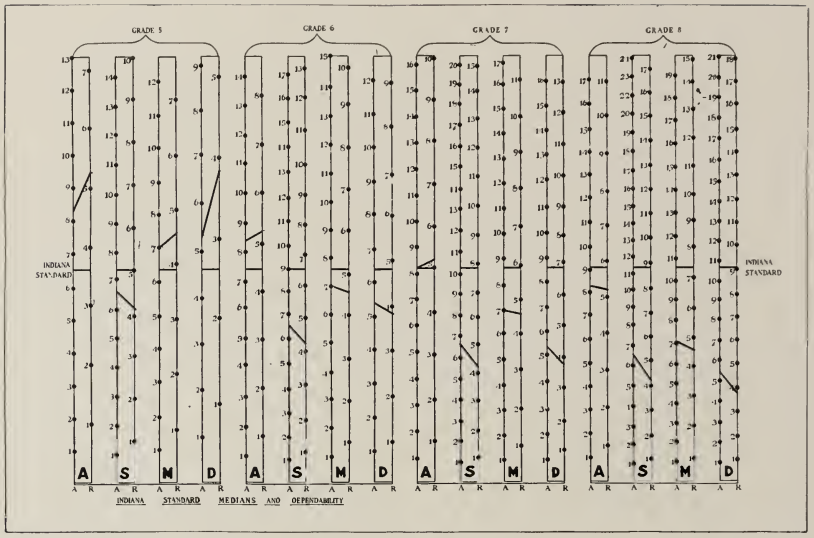

FIG. 9. MEDIAN SCORES IN ARITHMETIC MADE BY A GROUP OF FACTORY WORKMEN IN INDIANAPOLIS (WAGES 20 CENTS PER HOUR)

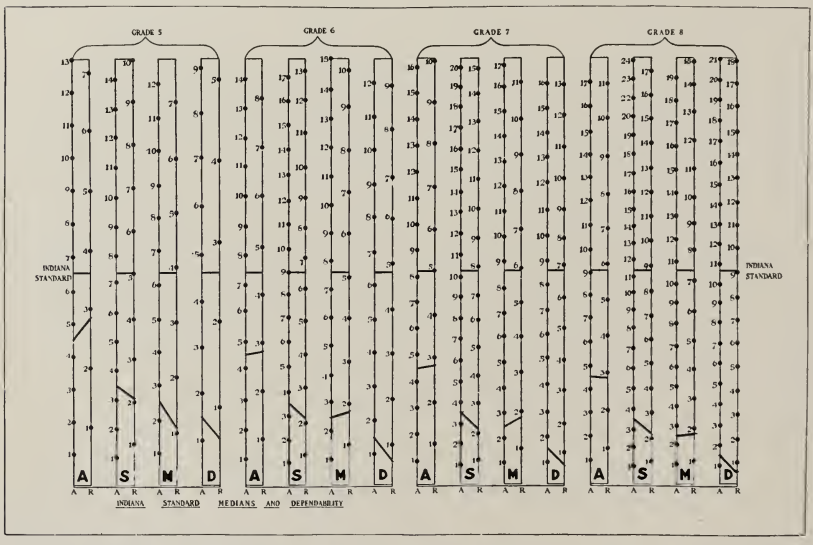

FIG. 10. MEDIAN SCORES IN ARITHMETIC MADE BY A GROUP OF FACTORY WORKMEN IN INDIANAPOLIS (WAGES 17½ CENTS PER HOUR)

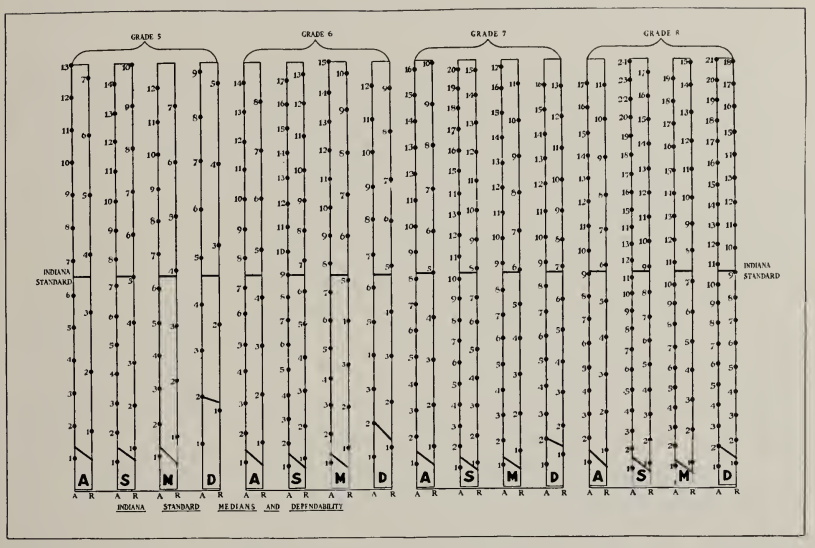

FIG. 11. MEDIAN SCORES IN ARITHMETIC MADE BY A GROUP OF FACTORY WORKMEN IN INDIANAPOLIS (WAGES 15 CENTS PER HOUR)

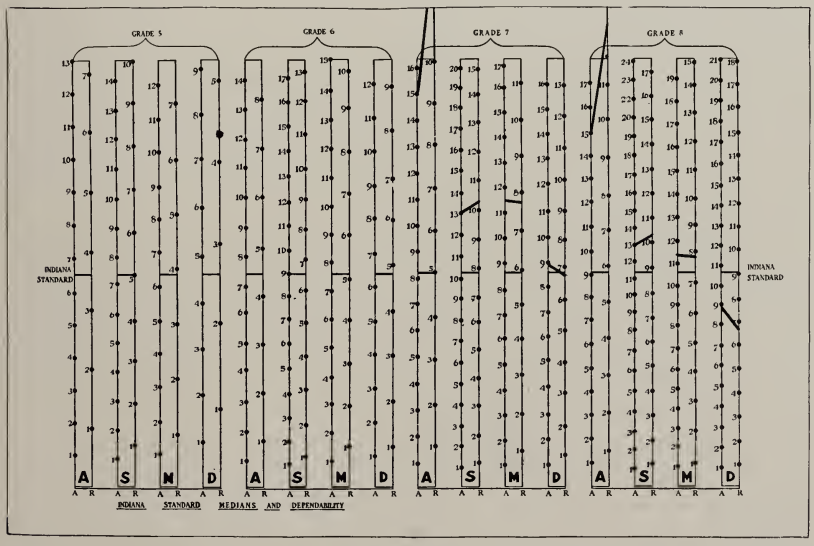

FIG. 12. MEDIAN SCORES IN ARITHMETIC MADE BY A GROUP OF SALESWOMEN IN AN INDIANAPOLIS DEPARTMENT STORE (JAN., 1915)

In the Boston schools there were twenty thousand children considered, and in the Detroit schools between a thousand and fifteen hundred.

Here is a group of charts which represent work which Miss Baylor has been doing in Indianapolis in connection with the workmen in certain commercial and industrial establishments.

This (Fig. 9) is the best paid group of workmen in a certain factory in Indianapolis, and we have charted the results on the fifth-grade scale, the sixth-, the seventh-, and the eighth-grade scales. If you compare them with the fifth-grade scores in addition they are better than the Indiana average; if you compare them with the eighth-grade score they are poorer in the average work attempted, but their dependability is just the same.

This group of workmen (Fig. 10) is paid less money. These two groups are interesting when considered together. Twenty cents an hour was the average of group "A", and seventeen and a half cents was the average of the second group.

This (Fig. 11) is the third group of workmen. They attempted less, but their dependability shows somewhat better.

This (Fig. 12) is a group of saleswomen in one of the department stores in Indianapolis. We graphed the results on the seventh-grade standard, also on the eighth. Here you see what happens to people who keep practicing in any one of these functions. The addition work is superior to the average of the seventh grade. These people are busy, are selling goods every day, and counting up small amounts of money. The average is better than that of the eighth grade in the Indiana schools, both in amount and in dependability; but when it comes to matters of division, you see the score is very much poorer.

Standards must be set not only for addition, but for all other topics in arithmetic and for every other subject to be taught. The big aims which catch our imagination and inspire us to do something must be supplemented with a thousand subsidiary aims which show us specifically what to do. These minor aims must be definite, and determined not by individual opinion, but by approved scientific methods. That in committing ourselves to this program we are not following false ideals will be apparent to any one who knows the history of any other science. Chemistry, physics, biology, and psychology have grown by the method of analysis and measurement. So must education. We shall command the respect of scientific men when we use their methods, and teaching will become a real profession to the degree that we develop a specific body of knowledge that teachers must master and use.

Definite standards have a value in educational research in addition to their value in school administration. Like the centimeter, ampere, and gram, an educational unit is the instrument of accurate knowledge about things other than the unit in question. With it, we can determine causes and effects.

All of us are aware that much of educational literature is the expression of opinion rather than the statement of scientifically determined fact, and one reason that illusion and unverified hypotheses have so run riot thru educational discussion has been the absence of accepted standards of measurement. Nobody could disprove anybody else's error.

If we were to ask the two hundred superintendents and principals here present how much time a child should have spent on the subject of reading by the end of the sixth grade, we would get a great variety of replies. Some of these answers would place the time at double the estimate of others, and an even wider range would doubtless be found in the practice of Indiana schools. Superintendent A allots 45,000 minutes; Superintendent B, 100,000. Which is right? The problem is important, for if a boy can learn to read in 45,000 minutes it is waste to have him devote an additional 55,000 minutes to the task. We might get into a heated argument if we should start a discussion on this question, but it would be like disputing with the ice-man about the weight of a cake of ice in the absence of a scale. None could convince another of his error. The case would be much simplified if an objective scale could be applied. The appeal would then be to an impersonal judge. If children spending 45,000 minutes score as high on the scale as do children spending 100,000 minutes, then the 55,000 minutes is sheer waste so far as the ability covered by that scale is concerned. From such a decision there is no appeal except to a more accurate application of a more accurate scale. Mere opinion becomes in such a case just as important as opinion about the law of gravitation, or the rotundity of the earth, namely, of no value at all.

Now any person accustomed to ponder over the problems of teaching can quickly think of a dozen questions to which he would like a definite answer—the problem of oral and silent reading, the problem of phonics, the problem of extensive and intensive reading, the problem of spelling, the problem of transposition, and so on. What does the employment of any one particular method do to the children upon whom it is used? For the solution of such

problems as these the employment of standard scales and tests seems necessary. They offer the same effective instrument of research as the meter and the gram offer to the student of physics. It is difficult to see how we can do anything for a science of education without them.

In the use of the Courtis tests last year we worked upon the time allotment in the case of arithmetic. Taking the cities with the highest median scores, we were able to suggest an optimal time for each of the four upper grades. It seemed wisest to suggest an upper and lower limit rather than a single definite number of minutes. This table gives the optimal time.

TABLE IV. OPTIMAL TIME TO BE DEVOTED TO STUDY OF ARITHMETIC FROM BEGINNING OF ITS STUDY TO END OF SEVERAL GRADES, AS DETERMINED BY RANKS 1 AND 2 OF REPORTED SHCOOLS[4]

GRADE	Minimum time in minutes	Maximum time in minutes
Fifth	30,000	45,000
Sixth	40,000	55,000
Seventh	45,000	60,000
Eighth	50,000	75,000

Nobody believes this table to be a final statement. Too many causes were at work producing these scores for so simple a solution of the time problem as this would be. It is something to have made the start, however, and we should be able to correct the time standard year by year until it becomes really reliable.

From these fragmentary facts I think you must see that in organizing the Bureau of Coöperative Research[5] we have two definite aims in mind. One is to extend the use of standard tests and other forms of scientific education, and in doing so to serve directly the schools which coöperate. During the current year there will be used in Indiana schools approximately twenty thousand each of the Courtis Arithmetic Tests,—Series B, and the Thorndike Reading Scales. We feel that in forwarding this work we are doing a service to these schools and to their teachers. Our

[4] *Indiana University Studies*, No. 27.
[5] *Indiana University News-Letter*, Vol. II, No. 12. December, 1914.

second interest is to collect material, to study it, and to work out in a scientific way whatever facts are indicated by the results of the work. Whenever the material seems of sufficient worth we shall publish it as a University bulletin. The first bulletin to be issued is the one dealing with the results of the Courtis tests which were given last May. This bulletin is now available. Other bulletins will be published within the year. The report of this conference will be published in this series. We shall expect to report on both the Courtis and Thorndike tests of this year, on the age-grade table of the first eight grades, and on the conditions and causes of elimination and failure in high schools. Thru these studies and publications we hope to serve the cause of education in Indiana in an even larger way than by direct service to the schools. If the cordial response with which this movement has already met should continue, we expect from year to year to increase its scope in order to attack other problems as we get to them.

It may seem to some of you that we are undertaking a large task, but at the risk of seeming even more visionary, I am going, for the sake of clearness, to tell you how the situation appeals to me. From what I know about certain universities of America, and from what I read in journals of psychology, sociology, medicine, and education about what is going on in other universities of this country and Europe, it seems to me that there is a great deal of information concerning educational matters which plays very little, if any part, in school work. Meumann is working on the memory; Thorndike and Courtis are developing standard scales; Terman is revising the Binet scale; Goddard is studying the causes and consequences of feeble-mindedness; Yerkes is developing a "point scale" for the measurement of intelligence; Winch is studying the perceptions of children; Stern is working on individual differences; Ayres, Strayer, and Cubberly are studying the problems of school administration, and one might continue the enumeration thru a much longer list of men and problems. These men and their studies are so widely scattered that it is difficult for any considerable number of Indiana school men to reach them. My idea is to make Indiana University a relay station for the best there is anywhere in the world in educational science. We would have wires from every productive university and scholar in the world to the library, laboratories, and faculty of this institution, and from this institution to every part of this State so that Indiana school problems may be solved in the light of the best knowledge

there is. When at all possible we will bring the scholars themselves here as we did a year ago, and as we are doing again this year. We will keep ourselves alert year by year to add whatever we can to what they bring, we will welcome contributions from you, and in all these ways we will strive to have everything as good as we can make it. Working altogether we shall serve ourselves, and the larger society of which we are a part.

FRIDAY AFTERNOON SESSION

The conference was called to order by W. A. Myers, Superintendent of the Hartford City schools, presiding officer for the afternoon.

Mr. Myers: One year ago the first Conference on Educational Measurements was held in this city. We come now to the second session of the second Conference on Educational Measurements. A word of explanation is necessary with reference to the program. Dr. Courtis was detained this morning because of failing to make train connection in Indianapolis. He came overland in an automobile, so that he might be here this afternoon. The talk that he was on the program to deliver this morning will be given at this time. After his address there will be a short intermission, and then a second address will be given by Dr. Courtis.

I should like to say, if you have any questions you want to ask Dr. Courtis on the first lecture make a note of them, so that you may ask them when the roundtable discussion comes on after the intermission.

I now have the pleasure of presenting Mr. S. A. Courtis, Director of the Department of Educational Research, Detroit Public Schools, who will address you upon the subject, "Supervisory Control by means of Objective Standards".

SUPERVISORY CONTROL BY MEANS OF OBJECTIVE STANDARDS

Mr. Courtis: Mr. Chairman, ladies, and gentlemen, it is a pleasure to come before such superintendents and teachers as those who attend the conferences here at the State University. In no other State can we gather together as large a group of people who are working unitedly on this problem of measurements, at least so far as my observations go. Some other States are pushing you pretty closely. You want to look out for Kansas and Iowa. Some of the southern States are getting interested also, and I hope that before very long we may have, not a State conference, but a national conference where we may bring together the results from the various States. At any rate, it is always a pleasure to come here and meet people who are working on these topics; and, think-

ing over what I should say to you, I decided that perhaps the best thing I could do would be to present in an orderly fashion the different ways in which the standard tests which are now available for school work may be used in problems of supervision and in problems of teaching.

I am going to take up this afternoon the question of the use of the standard tests for problems of supervision, and in order that you and I may understand each other I am going to give you in my first slide an outline of the points which I wish to cover. I do not know just how many of them I can cover in the time at my disposal but I should like to discuss as many of them as possible.

You will find in this slide, for instance, that I have listed a selection of those problems which seemed to me very vital in the work of supervision and superintendence. Three of them you note I have described as mechanical. Three have in them the problems of control of human agents. To my mind the very first question we have to settle is what we want our schools to produce. What kind of product are we going to have from the work that we are doing? I do not see how we can do anything well when we have no clear conception of what it is we are trying to do. So that the very first work of supervision is to set definitely the aim of the teaching, the products which are to be produced by the school work. Ordinarily you will find these formulated in the course of study. I want to make clear this afternoon the importance of objective definition of aim as a factor in the making of courses of study.

The second point we have to take up in connection with the school work is the study of the method by which the aims are to be reached; such methods as are ordinarily represented in text-books, or devices of various kinds in the classroom. In educational measurement we have already arrived at a place where standard tests can be used to very great advantage to settle all such questions on a basis of reliable information as to the actual effects produced.

The third type of factors that needs to be considered are those which affect the conditions under which teaching is done; the amount of time given to the subject, for instance. As I looked over the reports of your superintendents this last year, I found a wide variation from one city to another in the time given to arithmetic. I am sure that when those results are available for you all, there will be changes in your procedure. My third point is therefore that no superintendent now has a right to make a fundamental change in the conditions under which his work is done;

that is, change in size of class, in amount of time given to subject, or in other conditions of that sort, without having a basis of measured fact for determining the effect of that change. Measurements with standard tests make such study possible.

On the other side of the work of supervision there is this problem of the control of the active agents in the teaching process. How is the superintendent to do that? After he has set his standards, are his teachers going to carry out his ideas and get those results the way he wishes? All of you know very well that if left to themselves, the teachers will fall far short of the plans the superintendent has made for them. One of the very serious problems of supervision must always be how to give the teachers the proper inspiration and training, how to control them, yet set them free, and I hope to show you that here as elsewhere standard tests are of very great assistance.

The next slide will show the important products of education.

Here again I want to divide the things I have to say about the products of education into two parts; for at this point there is a chance for grave misunderstanding, and unless you and I understand each other here, you are likely to misinterpret all that I have to say later.

We have two types of products: those easily measurable and those which are measurable only with difficulty. Among the easily measured products is that of physical development. We do not know much about that. As it goes thru school, the child develops anyhow, physically and mentally, much as the trees grow, but what I want to call your attention to is that for many years we had units of measurements for the physical development of the child, altho some of you superintendents have not made very much use of them. Weight, vision, lung capacity, and many other important facts are easily measurable and I want to prophesy that you will eventually come to see that a very large part of your problems is bound up in these measurements.

Another product, especially in the early grades, are the mechanical skills, that is, handwriting, reading, and the like. In addition to these, the third type of product also is of very great importance, the habits of work which the child forms. These have not been measured much yet, but they are easily measurable, and I think that in the next year or two you will find many studies of this sort.

If you take the other part of the school work you find we have, first of all, this question of knowledge, which we have always measured more or less, but measured very poorly. The ordinary

examination is an attempt to measure the development of knowledge. Then there are a number of tests, like those range of information tests, which are designed to measure the actual knowledge which the child has received from his course. I want to make the point that all knowledge of this character is only measurable with difficulty. It will be some time before such measurements can be made satisfactorily because in all such measurements either reading or writing enter, and until our English work is brought under control, we shall be unable to interpret correctly the results secured.

For the same reason I say that it is difficult to measure the amount of culture which the child gets from his course, but I want to make this point with all of these, that they are measurable. If, for instance, I could follow the children of your geography class to Sunday School and hear them sing; if I had any way of determining what was going on in their minds as they stood up and sang:

> What though spicy breezes,
> Blow soft over Ceylon's isle;

if I could trace their thoughts and emotions as they sing those words, could I not then tell very definitely the cultural effect of your geography teaching? It is difficult to make such measurements now, but they will be made ultimately, as will also measurements of those other products, the ideals and inspirations which the child gets from his work.

Do not misunderstand me. Measurement as you know is new. We have not been working at it very long. I think everyone who is measuring, who is doing any work in measurement, recognizes that the highest product of school training is that which leads to the development of ideals and character in the children; but some of us have become so convinced that successful work in this line is absolutely dependent upon the successful work in developing the fundamental skills, that we are giving our attention almost wholly to the mechanical elements. In other words, at the present time, most of the work, the successful work in measurement, is being done at this point (indicating); and if you entirely misinterpret a great many other things, I say to you, please understand that such work is being done in order that these lower mechanical products may be gotten out of the way as quickly as possible in order that this other work may be better done.

I call the attention of everyone here to the fact that you are now giving time to the development of these mechanical skills. In

my judgment you are giving too much time, doing the work entirely too inefficiently. You are taking from the child a great many opportunities he might have for cultural and inspirational work because of that inefficiency; and my purpose in the work which I have to do is to so arrange the methods of school work that we may get the mechanical skills out of the way in the least possible time and in the very best way, to save time from them for the more important work which is represented on this side of the chart (indicating).

If you understand that point clearly there will be no danger in my talking to you for the rest of the time about these mechanical skills, but unless you do understand it you will fail to give me the credit which I deserve for the kind of work which I am doing. I am working for precisely that thing which everyone of you is working for, the development of the highest interests and the highest ideals of the child. The studies which have been made so far show very plainly that the cultural and inspirational work is conditioned by the proper equipment of the child with the mechanical tools by which all mental work is carried on. Therefore we are giving our time to such mechanical skills; not neglecting the cultural works, but on account of the increased efficiency of our mechanical work, actually giving more time to this phase of the child's development than we have ever given to it before.

Let us pick out one of these particular mechanical skills and see what can be done in the way of defining the course of study in objective terms. If you will look over your course of study, unless it has been rewritten in the last year or two, you will probably find that it says that a child ought to be able to add, subtract, multiply, and divide with a reasonable degree of rapidity and with sufficient accuracy, etc. As I see it the attempt to measure is the attempt to determine the amount or the degree of skill and accuracy which is reasonable.

SAMPLE EXAMPLES FROM A SERIES OF TESTS IN COLUMN ADDITION. EACH TEST WAS COMPOSED WHOLLY OF EXAMPLES OF ONE TYPE, AND WAS OF SUCH LENGTH THAT NO ONE FINISHED IN THE TIME ALLOWED

A	C	E	F	G	I	J	K	L
8	5			7				
3	6			5				
	2			8				
	7			9				
(B)			4	4	8	3	4	8
			7	3	3	49	557	9,659
7	(D)	9	2	9	4	66	892	3,778
4		3	2	7	4	75	347	9,484
	7	6	4	9	7	32	562	5,247
(H)	6	4	9	7	8	96	738	8,470
	2	8	2	8	7	85	658	7,966
9	7	2	5	5	6	64	273	6,323
2	4	3	2	2	2	59	797	3,277

If we try to make our aims definite we shall find by measurement that addition is not a simple thing. Take, for instance, the accompanying examples. I want you to notice that these examples (A) have only one addition. These (B) you see have three. These (C) have more, and you see the columns increase in length.

Here is an example (L) made out of several columns of the same size, and so on. A little psychological study will show that each of those abilities is a different ability. The child may be able to do test "A" without being able to do "C"; able to do both "A" and "C" and not able to do "L"; and so it goes. What do you mean by ability to add? It is not enough to make a general aim of that sort. It must be definite and specific.

In the slide (Fig. 13) now before you I have the actual records of children tested by those examples of the different types. The numerals at the bases of the graphs indicate the number of additions per column. The scale on the left of the figure shows the number of additions made per minute. It is my own record. You will notice up here at the top that I add quite uniformly at the rate of seventy-two additions per minute, whether the column be two figures long or thirteen figures long. The size of the column does not regulate my rate of addition for the first minute.

Now look at this curve (indicating Fig. 13, graph LF). If the column is one, two, three, or four figures long you notice the rate is constant. Two more figures on top of that will reduce the rate. To add columns six figures long is not the same thing as to add columns of four figures. The first are about twice as hard. Look at this one (indicating Fig. 13, graph A). This child leads this particular class on the single column addition, but by the time you get out here (indicating) to twelve figures in the column, you will

find that child is at the lowest end of the class. You see how the rate decreases. And so if you study those curves you will find that each individual child will respond differently to those different types of examples.

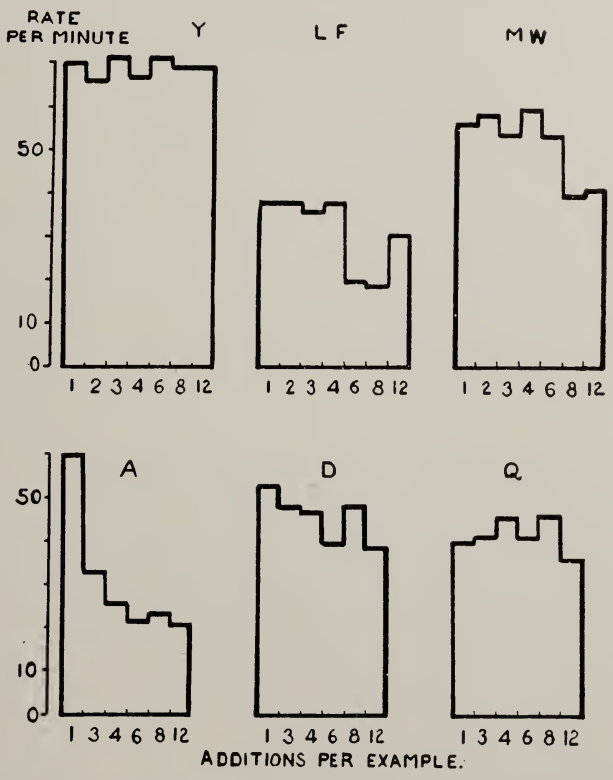

FIG. 13. CHANGE OF RATES WITH COLUMNS OF VARYING LENGTH

Vertical scale = number of additions per minute; horizontal scale = number of additions in each example of the test

If we want to define addition we must define it in such a way that it will cover all the abilities which are involved. I have listed here four of the important abilities which enter into addition. Thorndike says that psychologically there are ninety odd, but these four are the four that must be controlled. The others are purely psychological in their nature, and are controlled indirectly. The first one is of course that the child must know all the addition combinations; and you will find in these four examples that all the addition combinations, the one hundred odd—there are not quite one hundred there; some of the zeroes and ones have been

omitted—are represented. So practically all the combinations are represented in the group of four examples.

Another thing we must look out for is carrying. The ability to carry is quite distinct from the ability to add, and has to be provided for separately. Therefore, we have several columns. Then we have the question of attention span. I just showed you (Fig. 13) the graph where the child could add when there were four additions and could not when there were six. The length of the span for most children is about six additions, so that we must make these columns eight or nine figures long in order to test the question of attention in the addition span.

Finally, there is the question of endurance. My own range is seventy-two additions per minute for the first minute. In four minutes that has dropped off to something like fifty-two. Therefore, we must make the test long enough to test the question of endurance in this one ability. We can do that by setting the time for a test in addition like this (Arithmetic Test No. 1—Addition) as eight minutes.

ARITHMETIC TEST NO. 1. ADDITION (SERIES B)

You will be given eight minutes to find the answers to as many of these addition examples as possible. Write the answers on this paper directly underneath the examples. You are not expected to be able to do them all. You will be marked for both speed and accuracy, but it is more important to have your answers right than to try a great many examples.

927	297	136	486	584	176	277	837
379	925	340	765	477	783	445	882
756	473	988	524	181	697	682	959
837	983	386	140	266	200	594	603
924	315	353	812	679	366	481	118
110	661	904	466	241	851	778	781
854	794	547	355	796	535	849	756
965	177	192	834	850	323	157	222
344	124	439	567	733	229	953	525
—	—	—	—	—	—	—	—

Now, the minute you have a test of that sort and you are ready to say "I want to teach the children to add examples of this type", the question comes up right away—I think you Indiana people are ready for it—What standard shall we set for the schools? For the different grades? And I have listed here the factors I thought ought to be considered in setting up a standard.

You notice I divide them again into two groups; those beyond control and those under control. Of those beyond control, I put first innate capacity. I will show you what I mean by that in a few minutes. Another factor is the way in which the mind and hand are geared together. A third factor is the maturity of the child, not in years but in development. Referring to the other type of factors we can control the amount of time we give to the subject. Our standards must also be determined somewhat by the relative value of the subject and somewhat by the social needs of the average child; so we must keep track of these different factors as well. Let me show you what I mean by each of those.

Here (Arithmetic—Test No. 3) is a test, for instance, of the multiplication table. How many answers in that test could you write in one minute? We have other tests of that kind in addition, subtraction, multiplication, and division.

ARITHMETIC—TEST NO. 3. SPEED TEST—MULTIPLICATION

SCORE—No. attempted ..... No. right .....

Write on this paper, in the space between the lines, the answers to as many of these simple multiplication examples as possible in the time allowed.

23907	95476	42749	34905
13654	12805	19605	27826
-----	-----	-----	-----
82754	25607	12708	12815
16906	35983	68763	95713
-----	-----	-----	-----
62895	43986	13765	32608
17407	26704	25809	14715
-----	-----	-----	-----
13603	16809	14804	73924
74809	42873	54935	18903
-----	-----	-----	-----
58605	19803	25457	16917
12394	32647	28905	82402
-----	-----	-----	-----
95476	23907	34905	42749
12805	13654	27826	19605
-----	-----	-----	-----

Name ..... School ..... Grade .....

Here (Arithmetic—Test No. 5) is another test in which there was simply the copying of figures.

ARITHMETIC TEST NO 5. SPEED TEST—COPYING FIGURES

SCORE—No. attempted ..... No. right .....

Name ..... School ..... Grade .....

Copy on this paper, in the space between the lines, as many of the printed figures as possible in the time allowed. Write as rapidly as possible, but form the figures as carefully as in working examples.

24967	42976	62947	72964	24976	42967	62974	72946
26974	46927	64972	74926	26947	46972	64927	74962
27946	47962	67924	76942	27964	47926	67942	76924
24967	42976	62947	72964	24976	42967	62974	72946
26974	46927	64972	74926	26947	46972	64927	74962
24967	42976	62947	72964	24976	42967	62974	72946

Fig. 14 is the record of an individual tested with the tests in such a way that we can compare the records.

On the first trial this individual girl, in May, 1910, wrote fifty additions in a minute. She wrote forty-four in subtraction and comes up to sixty-three in multiplication, and down to this point in division, and copies one hundred figures per minute. Now that individual had five tests in succession, and of course when you take five tests in succession there are changes in your score. You note the different trials, one, two, three, four, and five.

The thing I want to call your attention to is the inequality of her development in these different operations. You notice how much better she is in addition than in subtraction; how much better in multiplication than in division. The second record was made two years later by a different examiner, using a different edition of the same tests, and yet you see how those inequalities of development have persisted, and practically in the same relative degree.

Suppose I should test all these individuals in this room in the same way, what kind of scores would we get? We would get results corresponding to this (Fig. 15) where we have different

types of individuals. I want you to see that those two individuals, twins, who look alike in their faces are alike in their minds. Both add better than they subtract; subtract better than they multiply; divide better than they multiply, and copy figures quite rapidly. In the left-hand graph we have two twins that are similar. You see how close the resemblance is in those two individuals. In the

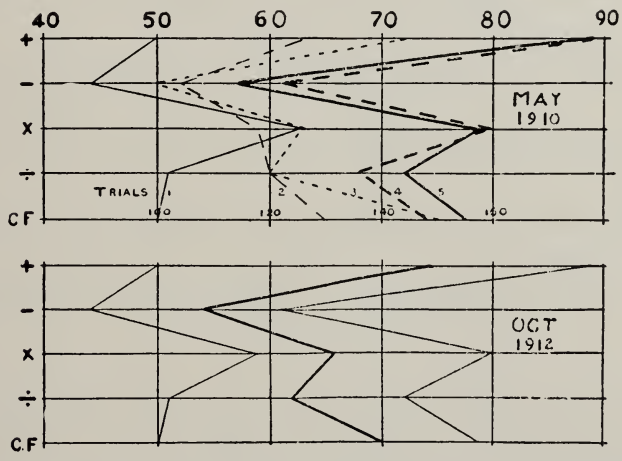

FIG. 14. SCORES MADE BY A SINGLE INDIVIDUAL IN A PRACTICE SERIES OF 25 TESTS

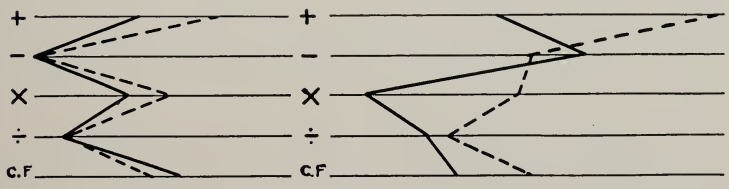

FIG. 15. CURVES SHOWING RELATIVE DEVELOPMENT OF TWO PAIRS OF TWINS IN FOUR OPERATIONS

right-hand graphs we have two dissimilar twins. These twins do not look alike in their faces. You would not know they were twins to see them. This one adds better than he subtracts, but this one subtracts better than he adds. If you follow the two curves you see how opposite they are all the way thru. In this case the unlikeness of their physical bodies is paralleled by the unlikeness of their minds.

What happens now if we test the whole family? We get results like this (Fig. 16). Here is the father, an architect, a college

graduate, a man who uses his mathematics. He wrote eighty answers per minute in addition. He does not do so well in subtraction; is lower in multiplication, and comes here and here in the other two tests.

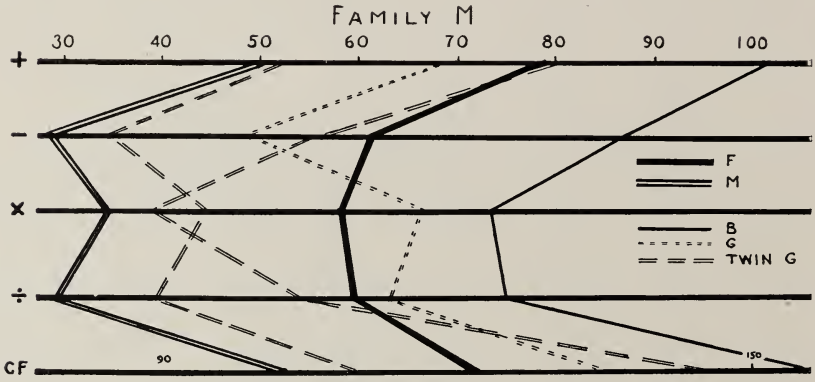

FIG. 16

This is the curve for his wife, coming down this way. You see they are opposite. I want you to notice that the man is weak on multiplication and the mother is strong. Now what about the children?

This (indicating) is the oldest boy, a grown man now, also a college graduate. Compare that curve with the curve of the two parents. Do you need to be told that he is a chip of the old block? Or what do you say about this girl here (indicating) whose curve follows the mother's so closely?

The particular point I want to make at the present time is this: Those children were trained in a different school, in another generation, and under different teachers from their parents, but the product is the same. How much control did the school have over that product? How far was the innate capacity to learn multiplication the determining factor in how much multiplication the girl learned? The interesting thing about the slide to me is the fact that these two lines are twins, this one resembling the father, and this one resembling the mother; one twin has the father's weakness in multiplication exaggerated, while this one is like the mother and has the strength in multiplication.

Now those two children had the same opportunities, the same training, and yet you have the slower sister leading her more highly organized twin in the one thing in which she has inherited strength

from her mother. So I say, the first thing that determines the standard must be the degree of capacity which the average child has for the type of training which we want to give him. We cannot fix that standard irrespective of the child. We must measure the child and see what he is capable of attaining under given conditions.

Not only is the response of the child determined by the character of the brain cells in him; not only do we find that he can do much more in certain fields than in others, but in all work in which nerves and muscles are included they are also a determining factor. Some people can set free energy at a very great rate; other people can move their hands and fingers but very slowly. We must take into consideration the speed and accuracy which it is possible for the average child to attain. In other words, our standards cannot be set arbitrarily. We must measure and find out every time exactly what performance the human machine is capable of before we can set any sort of reasonable standards.

Still another factor is maturity. Here is a test in which there is no thought element. The child is simply to copy those figures. How many figures can you copy in a given time? Purely nerve and muscle and eye. Almost any child, even the children in the kindergarten, can take this test. In New York City we measured twenty-seven thousand children and here is the result—twenty-seven thousand, of grades ranging from three to nine. Note the gradual progress in the curve. That is not due to training, or to incidental training at most; for we have evidence to show that the simple "getting older" of the child is enough to raise its score in this operation.

The child's ability changes irrespective of your teachings, simply because that child is growing older. His nerves and muscles are maturing, and there are changes taking place which enable him to perform in a way differently from that of the year before.

We have to take that fact into consideration also, and set our standards in terms of the development of the child.

I want you to notice the record (Fig. 17) of a certain individual in the additional test. This was the test I showed you before in addition. There is a similar test for subtraction, multiplication, and division. The broken line is the record for the class. The solid line is the record for an individual in the class. I could duplicate this record from your classes everywhere. You notice the class is low. It evidently needs training. It is lower than the average

Measure the efficiency of the entire school, not the individual ability of the few.

COURTIS STANDARD TESTS

IN

Reading, Writing and Arithmetic

ARITHMETIC
Series B

INDIVIDUAL SCORE SHEET

Name Libray, Girl (BOY OR GIRL), Age last birthday 12

School ____ Grade 7 B Room ____

City ____ State Mich Date 11-12-13 - 11:15

SCORES

TEST	SUBJECT	ATTEMPTS 1st Trial	ATTEMPTS 2nd Trial	ATTEMPTS Change	RIGHTS 1st Trial	RIGHTS 2nd Trial	RIGHTS Change	CLASS 1st Trial	CLASS 2nd Trial
No. 1	Addition	12			10				
No. 2	Subtraction	16			15				
No. 3	Multiplication	15			14				
No. 4	Division	15			13				

GRAPH.

ADDITION Attempts	ADDITION Rights	SUBTRACTION Attempts	SUBTRACTION Rights	MULTIPLICATION Attempts	MULTIPLICATION Rights	DIVISION Attempts	DIVISION Rights
20	20	20	20	20	20	20	20
19	19	19	19	19	19	19	19
18	18	18	18	18	18	18	18
17	17	17	17	17	17	17	17
16	16	16	16	16	16	16	16
15	15	15	15	15	15	15	15
14	14	14	14	14	14	14	14
13	13	13	13	13	13	13	13
12	12	12	12	12	12	12	12
11	11	11	11	11	11	11	11
10	10	10	10	10	10	10	10
9	9	9	9	9	9	9	9
8	8	8	8	8	8	8	8
7	7	7	7	7	7	7	7
6	6	6	6	6	6	6	6
5	5	5	5	5	5	5	5
4	4	4	4	4	4	4	4
3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0

INSTRUCTIONS. In each column mark the number that corresponds to your score for that column. Then with a ruler draw a line from each number so marked to the next. Draw a curve for the class scores in the same way, using a dotted line. By comparing the two curves you can tell how much your scores are above or below the class results.

FIG. 17

of most classes. This girl is very high, and works very accurately in everything except addition. Even in addition she was very high compared with the class. How much more training does she need? How high shall her score go before her work in addition is finished? That question, in setting the standard, must be determined not only by the factors of which I have already spoken, but by the further factor of the value of addition, and the need for addition in the life of the child. We haven't very many figures on that. We are getting more. Miss Baylor, of your own State, has supplied some information by measurement of people in certain industrial positions, so that we can begin to see where abilities are essential to social efficiency.

In the next slide I can show you how much superintendents can do; that is, superintendents in Iowa. If I were to measure superintendents in Indiana I should get similar results.

We had at a conference forty-four superintendents and teachers, mostly superintendents, and instead of asking them to write their names I had them write their salaries. They ranged like this (indicating). One man only was earning from five hundred to one thousand dollars; fifteen from one thousand to fifteen hundred, and there was one man who was earning forty-five hundred. What kind of scores would they have in addition? Is there any connection between salary and ability to add, as measured by this test? The evidence from this and other records tends to show that there is; that if you start out with zero on the scale your salary will increase as your ability increases up to a certain point. In this particular group of superintendents we did not get on a curve at all until we reached this point (indicating). This man who had the lowest salary had also the lowest score. Of course that is only one case. I have other records of this kind which fill in the curve.

Notice this group of fifteen who had this salary (indicating). Their range was from that score down to this score. The median falls here (indicating).

The median of this group is here (indicating) and the median of this group is here (indicating); and if you take the median of these other groups you find it follows along that line.

Now I have repeated that experiment on a good many groups. I am quite sure if I should attempt that experiment here, your average score in addition would be just about sixteen examples. In other words, sixteen is the average of adult ability.

I have measured a number of bookkeepers and a number of other people engaged in commercial work. I know that they varied

from twenty to twenty-four. I have some of them whose scores run up as high as forty to fifty and sixty in the same time. There is no limit, apparently, to ability in addition. Where are you going to stop? How much should an eighth-grade child have? If you are going to give all he possibly can take, he is capable of training up to adding sixty of those examples in eight minutes. If he has no training he will be unable to do any. Where are you going to put the goal? I say that the goal should be fixed at the average, the median speed of children of that age or grade. If we take the median speed for the grade we have a speed which can be reached by at least fifty percent of the children. A very striking thing comes out when you come to measure the classification and distribution in the different schools. In any of them you will find some children very high and in any of them you will find some very low. The median for any grade, however, will not be very different.

TABLE V. STANDARD INDIVIDUAL JUNE SCORES IN NUMBER OF EXAMPLES ATTEMPTED (SPEED)

GRADE	Test 1 Addition	Test 2 Subtraction	Test 3 Multiplication	Test 4 Division
3	3	4	3	2
4	5	6	5	4
5	7	8	7	6
6	9	10	9	8
7	11	11	10	10
8	12	12	11	11

Standard accuracy = 100%

In the accompanying table (V) you notice the standard scores as we have them determined. Professional ability ranges from twenty to sixty. The ordinary adult who is not using his mathematics professionally has a score of about sixteen. Now considering the maturity of the children, twelve is a reasonable score for eighth-grade and twelve is just about the median speed of work. As we follow down the line we find that we get a score of three for the third grade.

Now we have a new situation. We can say to the eighth-grade teacher, "Your work is to develop the adding ability of the children

until they are able to add twelve examples of the type shown there in eight minutes. When you have finished that work you have finished the amount of training in addition which you should give." That is a perfectly definite task. If I ask a carpenter to prepare this stick I give him definite specifications, length, width, and thickness, and the kind of wood. When he gets thru he knows whether or not he has come up to those specifications. If it is important that it should not be six inches shorter, and he brings me one six inches shorter, I can reject it because it does not come up to the specifications. Why should we not give our teachers just exactly as definite specifications in every mechanical skill, because it is the degree of skill and not the skill itself which is called into question by different people? The business man does not say the child does not know anything about adding. He says he does not add at the proper speed and with proper accuracy. He does not say the child does not understand English at all. He says he is not intelligent and cannot follow directions. He does not say he cannot read. He says he reads too slowly, and misunderstands what he reads. Why should we not, where we are dealing with mechanical skill, give absolutely definite specifications of this type?

For instance, here is the question of reading and writing numbers. You all teach that. Why not make your course of study like this? This is the course of study which I had for my teachers. We want the children to begin and read single digits. They must be able to read numbers as large as this (indicating) before we get thru. Here is the sixth grade, from this point to this point (indicating). All of the children ought to be able to read numbers so large (indicating), and if they can read them they can read those below them. If you specify the product like that, it is possible to make a test like this (indicating), which would involve ten of the numbers within that range. You notice this number has every figure, and this one has ciphers in it; so that we cover that difficulty.

The minute we have a definite specification of the aim of teaching, then we can say that a sixth-grade child ought to be able to read the test in a proper time; in this case the time was forty-five seconds.

Now unless you have tried the attainment of a definite objective goal of that kind, you have no conception, absolutely no conception, of what in the way of effort or in the way of change is required in the children to enable them to reach that goal. It is true that this particular test is a trivial point of mechanical skill, but never-

theless it has value, and it permits of the idea of measurement of the children at the beginning to determine where they are, of excusing the children who have already attained that goal from the class work, thus saving time from that for more important study, and it means the possibility of keeping track of the children as they work along, and of setting them free from the drill work the minute they reach that goal.

Take this question of fractions. Instead of saying the children should add, subtract, multiply, and divide fractions, why not specify that the denominator shall not be larger than twenty-four? We do not use fractions very much larger than that. Why not specify the character of fractions; that they require the simplest reduction to a common denominator before they are added, and that after they are added, they will require reduction to a mixed number? You will find that these examples are made on definite specifications. I can make any number of tests of that character.

If you are teaching fractions to the sixth grade, you tell them that they must practice working with fractions until they can do the eight examples correctly in five minutes. Then you transfer the responsibility to the child. That is the child's job; not the teacher's job. She is there to help, but the child must make an effort; and when he makes the effort, let him attain to the skill in the easiest way. Here again, as soon as the essential skill is attained, it is perfectly possible to excuse him from that useless mechanical work and put him at work at something which will develop other abilities worth so much more than this.

The same thing is true in handwriting. I use this illustration because I think Professor Thorndike was the first one to put out this idea of the limitation of training. He suggested that thirteen on his scale was good enough for all practical purposes, and when the child had reached that he ought to be excused from his handwriting drill. How many children have you in your drill classes in writing whose writing is better than thirteen? Or sixty on the Ayres scale? How many have had that ability for several years; have gained absolutely nothing from their drill, and yet who take their drill day after day? I can tell you pretty closely. Efficient handwriting instruction is about twenty percent, that is, about one child in five can probably do better than thirteen on this scale. Why should not those be excused from the handwriting drill, providing their English papers and spelling papers are up to standard? Have you ever tried it? It totally changes the situation, because then the child has an incentive to practice. If he is going

to take the drill needlessly it is something that he endures. He takes no direct part in the work himself and is indifferent about it.

We can do exactly the same thing with reading. The eighth-grade child ought to be able to read about two hundred and thirty words a minute, and be able to remember half of the material which he has read on one reading (for a short paragraph). You can do the same thing with English composition. It is perfectly possible to define in very definite terms exactly what you mean by the standard to be attained in any grade. In this grade we have the first part of a story which was dictated to the children, and the children were asked to complete the story.

The next slide will show the papers turned in by the teachers after being marked by them.

The teacher in this case called this an "A" paper—I don't know whether you would or not. The teacher in this case called this an "E". I don't know whether you consider that bad enough for total failure or not. But if all the children are tested under uniform conditions and the results are brought in in this way, the scores of the different teachers brought together will give a chance to see very definitely just what the standard for any system is.

I have posted on the wall as one of my charts a series of five papers marked "B" by the teachers, that you may see the variation from school to school. I have put there also a series of twenty-five papers representing standard samples, "A", "B", "C", "D", and "E", for each grade from four to eight—these are from a combined group in my own home city—in order that you may see a collection of such samples together. After securing samples of this kind, they may be marked by scales for turning the scores into marks on an absolute basis.

We have done that in one school system. In other words, here is a group of thirty or forty papers submitted by thirty or forty teachers. This represents the value on the Hilligas scale for that particular "A" paper. That was a representative paper of all the "A" papers. The same way this was representative of the "B" papers, and that of the "C", and that of the "D", and that of the "E", making marks of excellent, good, fair, poor, and failure, represented for each grade. If we compare all these samples with the Hilligas scale, and turn these marks into a definite absolute measure along an objective scale, we can see that the progress from the fourth to the eighth grade in "A" papers is represented by that line; but if we compare these (indicating) you will find that in this particular school system the "A" paper of the fourth

grade is just about equal to the "B" paper of the eighth grade. That is, the progress from the fourth to the eighth grade in English composition in this school system was such as to change the value of a mark just one grade. Thus it is possible to formulate in very definite terms, and to define the ability which should be attained at each grade in English composition.

Fig. 18 is a collection of eighth-grade standards in English. For handwriting, sixty by the Ayres scale; for rate in writing the original story, that is, rate of composition, about eighteen words per minute. Such measure may seem like a mechanical thing, but it measures very well the degree of imagination of the child, if you use with it the quality of the child's composition.

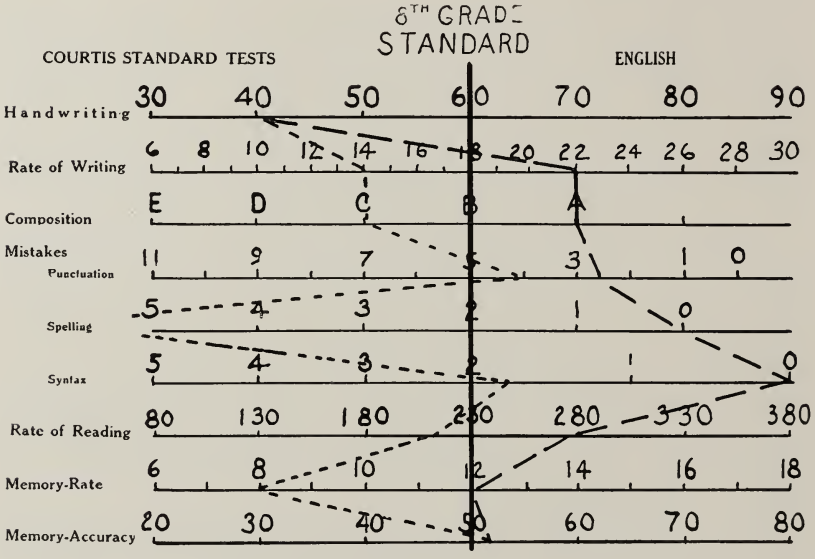

FIG. 18

He ought to be able to read about two hundred and thirty words a minute and reproduce what he has read at the rate of about twelve words a minute, and have about fifty percent of his reproduction like the original. If you carry such records thru with a single individual you get a curve something like this (indicating). You see how far this particular individual exceeds the standard. On the other hand, you see how much this one needs training. It is above the standard here (indicating), and here (indicating), and below here. Why should we not pick out points of excellence in the child, and excuse him from drill work of that kind, and let him

concentrate on the things in which he is weakest, and in which the child needs drill?

My point is that your course of study at the present time could easily be filled with many definite objective statements of aim which would be so specific that they would aid the teacher to determine exactly when the child's mechanical work is completed, and would enable him to control by these standards the amount and character of drill work done in your different school systems.

Now what about methods? Once you start out to try to reach a definite objective goal of this kind you have a chance to express the degree of success you have in that work. We tried that in Detroit. We started out at the beginning with work in the tables. We found we did not have very much progress. We found finally that there was little correlation betwen tables and the use of them. So we tried the method of working without any tables, that is, teaching a child the addition combinations while he was learning to add —teaching him directly. Here is the result.

These two schools carried on the work in the regular way. These two, 334 children, had the number book. These two had the same amount of time given to oral drill, because the superintendent at that time was a very firm believer in that type of work. At the end of the period, about a half-year, the test was made. We graded the children this way. We had 22 percent of the children in this group of schools that gained three or more examples in their score. We had about 37 percent that gained from one to three examples; about 27 percent that showed no change of any kind as the result of that work. We had about 13 percent who lost a little in the score, and about 1 percent that lost a great deal. If you follow that in a diagram, you can see it more plainly. If you compare that with this (indicating), you will see how much better the one method is than the other. It is another case of specific training.

You notice the percents are larger in the direct training method. If you look at the diagram you will find that this radius has swung around until it includes 53 percent, and we have 27 percent making a small gain. You see how much the number of children who make no gain, or loss, has been reduced. I could show you a chart where this radius for a single class has swung around until we had 80 percent of the children in that group (indicating). But we have in a very definite sense a measure of the efficiency of those various methods; and my point is, not this particular experiment, but that this is typical of the kind of thing which every superintendent

must do to justify the changes in his course of study or methods of work.

We have in Fig. 19 a record of the changes we have been making. This dotted line is the standard score in speed for the addition examples I showed you before. If you can see this line marked

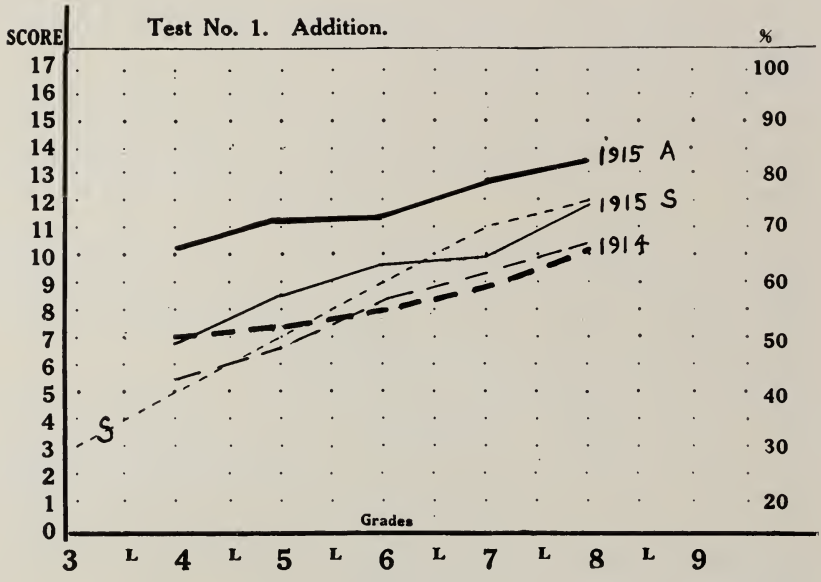

FIG. 19

"S", it represents the speed line for Detroit this last January. The standards of speed are fixed by factors over which the school has no control, but accuracy is determined by the efficiency of the training. The speed curve shows only a small change from the standard, but look at the accuracy line. This curve at present is high. You see where this fourth grade in accuracy is. You will find our present fourth grade in accuracy exceeds that of the eighth grade for a year ago; and I believe they are going to make that still higher. Not all the teachers are using that method effectively, but those who are, are getting results like that. Changes are still going on.

Here again the point is not the particular experiment, but the fact that every one of you every time you adopt a method, ought to have such absolutely definite information, or if you cannot get it from some other school system, you ought, at least, to measure your condition before you make the change, and a suitable time after

you have made the change, measure again to prove that the change has been beneficial.

That statement applies, of course, to every condition that comes under your control,—the course of study, size of class, ability, teacher, and every single factor of that kind. What do you know about the effect of size of class, for instance? I wonder how many of you have read Harlan's study of the effect of size of class in the promotion rate? He shows there is no connection, but if anything the larger class is better. Here is the record for five classes of fifty to sixty children. Here are 258 classes of forty to fifty children, and 168 classes of from thirty to forty children. Which of those three groups would make the better score in such a thing as the four operations with whole numbers? The curves here tell the story. This (indicating) is the forty-five, this is the thirty-five. You see in three of the four grades the classes of forty-five are ahead. Here the other one is ahead. Then they go along together, in speed, and the conditions are practically maintained here for accuracy. Where do the fifty classes come in? There were not very many of them, but that dot (indicating) represents one. This (indicating) represents two more. This (indicating) represents the rest of them. You see that in three cases out of four the larger classes are ahead.

Now please do not misinterpret these data. They do not mean at all that the smaller classes are not important, or that smaller classes are of no value, but that smaller classes do not determine the product. When you are dealing with mechanical skills, such as addition, subtraction, multiplication, and division, the small classes is not a very important factor. I would not do anything to discourage the desire to have small classes for many types of work. Nevertheless, I believe you will see larger classes for mechanical work. I think you will see classes of eighty to ninety in handwriting, in spelling, in reading, and things of that nature, which involve merely mechanical skill. For the result is not determined by teaching. It is determined by the changes within the child himself. The main factors are the factors which I have just shown are beyond control; and it is easy to show that when the work is adjusted to take advantage of such factors, you get a very large product.

Suppose you had the choice of a family into which you were to be born when you came into this world. Suppose there were two families where the father and mother were equally cultured, equally well supplied with this world's goods, equally anxious

to do their very best for their children; suppose that in one family you would be the only child, while in the other family you would be one of six or eight children; into which family would you choose to be born? When we deal with these mechanical skills we sometimes have to provide special machinery to get the teacher out of the way. It is not what the teacher does that counts. It is what the child does and thinks, and until our work is organized to take advantage of those factors we cannot hope to improve the efficiency very much.

Fig. 20 is a collection of results from classes of different sizes in schools in different counties. A class of thirty-five children from a New Hampshire school, and eight from a little country school in

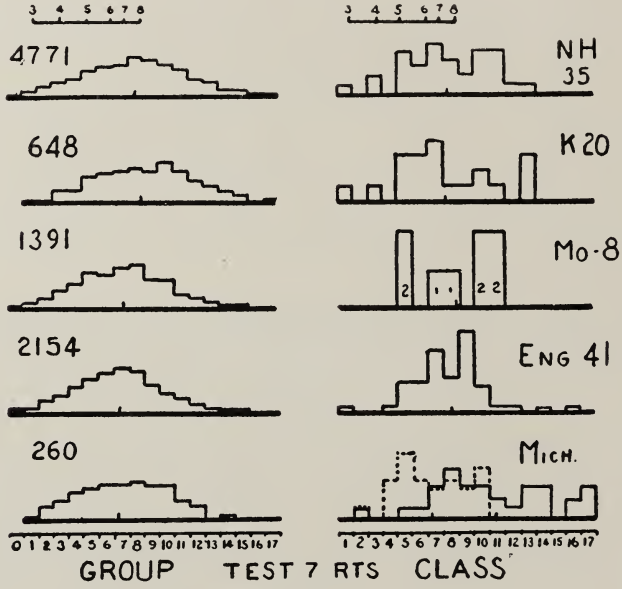

FIG. 20

Missouri, a class of forty-one children of the same grade from a school in New England (indicating). Here are the best and worst of twenty classes of the same grade in one city. This is the best score, and here is the worst score. Here is the scale at the bottom. Do you notice how those classes make about the same average score? You see that the distribution of individual scores by classes is about the same for each; for you have some children with very high scores and you have some with very low scores. The conditions are very nearly the same thruout. That is the best class, and that

is the worst class, and yet the difference is only that (indicating). Factors like the size of classes, which we ordinarily think of as important, are really not very important. You have the same thing shown on that side of the screen for the larger groups.

Here is a slide showing the relation between the time given to arithmetic and the product. These schools gave from 17 to 22 per cent of their time to arithmetic, and these only from 7 to 10 percent per week to the study of arithmetic. What kind of scores do they make? This score on the top, this X, means the scores of classes in abstract work, and this circle the scores of classes in reasoning. If there was correlation the dots, circles, and crosses would be distributed along a line like that (indicating), but the actual scores follow no such line; instead they fall there and there and there (indicating), which means that the correlation is low.

What did these people in the highest group get for all the time they spent? Going over the results of the Indiana investigation, I find you have a variation for time allowance in arithmetic which corresponds pretty closely to that shown in the slide. What are you going to do about it? Keep on spending time, 22 percent of your time, on arithmetic and getting no better result than these people do who spend but 10 percent of their time? But until you know what the conditions are by measurement, and until you see what you are getting for the time you are expending, the conditions

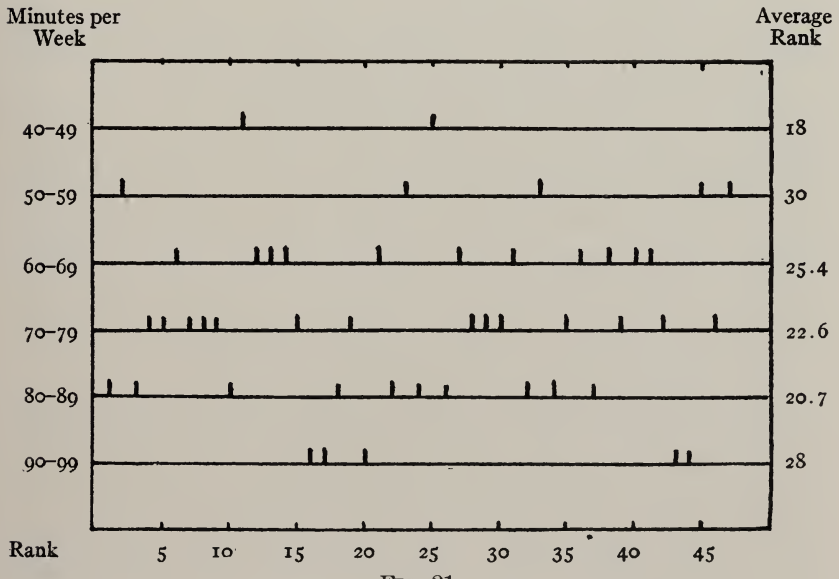

FIG. 21

will never be improved. Time as a factor has very little effect upon the product. If you give too little time you will get a very low product, but providing you give from 10 to 12 percent of your time to arithmetic, your product in these mechanical skills will be as good as any other person, provided you both use the ordinary form of class drill.

Fig. 21 is Freeman's study of the correlation between time and product in handwriting. You notice how little correlation there is. The variation in the amount of time given to handwriting was from forty to one hundred minutes per week with very small differences in the products, and yet I believe that some of you hold that time allowance is a very important factor. My point is merely that now you must justify such opinions in terms of objective results. The time is coming very quickly when such proof will be demanded from the outside, and wise superintendents are now taking steps to get such facts of their own initiative.

Here is the same kind of data on the ability of the teacher. Some of you superintendents are very peculiar. You look the country over to find a fine teacher, one with exceptional training, and exceptional intuitive judgment in the handling of individual children. You put her in a situation where she can make no use whatever of those abilities. By the classroom conditions you put upon her you nullify her ability to work with individuals. As a result the attempt to correlate the ability of the teacher, or the amount of training which she has had, with the results she gets, will show that the ability of the teacher is a negligible factor, when you consider the product in these mechanical abilities.

Here are teachers in Detroit, and their ranks as given on the efficiency cards used in the city. They are divided into groups. This group represents a rank of from 100 to 90; this 90 to 80; this 70; this 60; and this 50. These vertical lines represent by grades the scores made in the classes of these various groups of teachers. Look at the lack of correlation. If you will follow the diagram thru I think you will find there is no correlation between the ability of the teacher and the result that she gets.

Here again the data do not mean that the teacher does not count, altho some people may think that is what it means, but they do mean precisely that so far as mechanical skills are concerned. In the few fundamental operations of arithmetic as measured by these tests, the effect produced by the teacher is not over, at the very outside, three examples. If you were to replace all the teachers that you have by the very best teachers there are in the country

over, you could only raise the score of our classes about three examples; but in the meantime the range within your class would be something like thirteen or fourteen or fifteen examples; and the better teachers you have the greater that range will be.

As soon as we have an objective standard of this kind we have a means of measuring efficiency in a way we never had before. For instance, we have in Fig. 22 the record of a single class in addition. These are the scores for the number of examples tried. The little figures written in each of the squares show the number of examples right. That (indicating) means ten tried and ten right. This one means that there was one child who had a score of ten tried and ten wrong; this one two wrong; ten tried, eight right. This represents the product from the class as it is at present. What we want to get, tho, as soon as we have adopted this standard, is twelve tried and twelve right, or better. All such scores would fall somewhere in this rectangle. Now the efficiency of the class, in the teaching of addition, is determined by the percent of the class that comes up to the standard. If you count the number of children that fell in that rectangle, you will find there were seven out of seventy-two coming up to the standard. The efficiency was about 10 percent. The average of efficiency in teaching ranges from 10 to 15 percent. Some people find that very discouraging. I do not see why. It is the statement of a condition which has always existed, but not the statement of a condition which must necessarily exist. Measurement tends to show that results are better now than ever before, and the fact that we are increasing in efficiency is encouraging instead of discouraging. That electric bulb (pointing) is a very inefficient means of converting electric energy into light. We waste a great deal of energy in heat; yet no one would say that it is of no value. So many of those children are not where we would like to have them, but that is because we never before had means of determining what we were doing; and now that we have the means of determining what we are doing we have also the means for improving it.

Take, for instance, the city of Detroit. This last January we had returns from 444 classes. There were 115 classes whose efficiency ranged from zero to 5 percent. Quite a large number—almost seventy-five—ranged from 5 to 10 percent; and so on. You notice also there were 130 classes whose efficiency ranged from 20 to 60 percent. What do you suppose is going to happen to our educational product when the efficiency changes from the present 15 percent to 60, not in 3 or 4 or 10 or 20 classes out of 400, but

Test No. 2. Subtraction. Standard Scores: Grade 3, 4; Gd 4, 6; Gd 5, 8; Gd 6, 10; Gd 7, 11; Gd 8, 12. Accuracy 100%

Score	Score in number of Examples Attempted																								Total
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
% 100	—	1	2	3	4	5	6 3	7	8	9 3	10 1	11 1	12 1	13 1	14 1	15 1	16 1	17 2	18	19	20	21	22	23	24	15
90	Figures in small type indicate scores in number of examples right.		—	—	—	—	—	—	—	—	9 1	10	11 3	12	13 2	14	15	16	17	18 1	18—19 1	19—20	20—21	21—22	22—23 1		9
80			—	—	—	4	5	6 2	7	8 6	8 2	9 3	10 1	11	12 1	12—13 2	13—14 2	14—15 3	15—16 1	16—17 1	16—17	17—18	18—19 1	19—20	20—21		25
70			—	—	3	—	—	5	6	7 1	7 1	8 1	9 2	10	10—11 1	11—12	12	12—13	13—14	14—15 1	14—15	15—16	16—17	17—18	17—19 1		8
60			—	2	—	3	4	—	5 1	6 1	6 1	7 2	8 1	8—9 2	8-9	9—10	10—11	11	11—12	12—13	12—13	13—14	14—15	14—16	15—16		8
50			1	—	2	—	3	4 1	4	5	5	6	6—7 1	7	7	8	8—9 1	9—10	9—10	10—11	10—11	11—12	11—13	12—13	12—14		3
0 to 49	0	0	0	0—1	0—1	0—2	0—2	0—3	0—3 1	0—4 3	0—4	0—5	0—5	0—6	0-6	0—7	0—7	0—8	0—8	0—9	0—9	0—10	0—10	0—11	0-11		4
Total							3	3	2	14	6	7	9	3	5	3	4	5	1	3	1	0	1	0	2	72

DIF. 17 25

Median Scores: Speed 12.0 COR. .1 12.1 Accuracy 80.0% 5.1 85.1 Efficiency 7/72 = 10% Standard Scores 12–12

FIG. 22

in the whole 400? It is perfectly possible just as soon as the teachers down here (indicating) can work as these do; and that to my mind is the hopeful feature of the situation.

Never before in the world's history has there been an opportunity like the opportunity before you school men. When people discovered the laws which underlie the action of the electric current a very great development was possible; and when we discover the laws which underlie the development of the human mind and character, the development will be correspondingly great and of correspondingly greater value. I say never before in the world's history has there been an opportunity like that before you school men and women. People who are at work on these problems, striving to change that situation into this one (indicating), have the opportunity to make the largest contribution which has ever been made to our civilization.

There are only one or two more points that I want to touch upon. My time is gone. I will take the training of the teacher.

I think that in the control of the teacher and in the training of the teacher it is only fair that she should use these measures herself. As I go around from one part of the country to another, I find a very great question in the minds of superintendents as to the way in which the tests are to be used. Only yesterday I answered a letter which said that the writer thought it was exceedingly wrong for the superintendent to use a test as a club over the head of the teacher. So do I. I do not believe in the use of a club in any situation, except where you are fighting a wild animal and have to protect yourself. There is no reason for using tests as a club. Why should you not let the teacher club herself? You will find that the teachers as a class are anxious to do their very best. They are suspicious of a person who comes in to test their work because they know that their work does not come up to the standard they would like to have it reach. They know their own shortcomings, and they are afraid when you measure them. But suppose the work is put on the voluntary basis. Suppose they are to use tests to determine for themselves whether or not their work comes up to the standard? To my mind the very finest thing about a standard test is this: It sets the aim and it gives the individual an opportunity to meet that aim in any way he pleases. It gives both control of, and freedom to, the teacher, and those are two things which the teacher appreciates. She wants to know just what you expect from her and she also wants to be free to meet that demand in her own way.

Now in Fig. 23 you have a chart in which all the returns from something like thirty-eight fifth grades are shown. Only one class in a hundred makes a score like that one (indicating). Only one class in a hundred makes a score like this one. What are the teachers of Detroit doing? Those are the returns of fifth-grade teachers. Every one of these black circles means there was a teacher

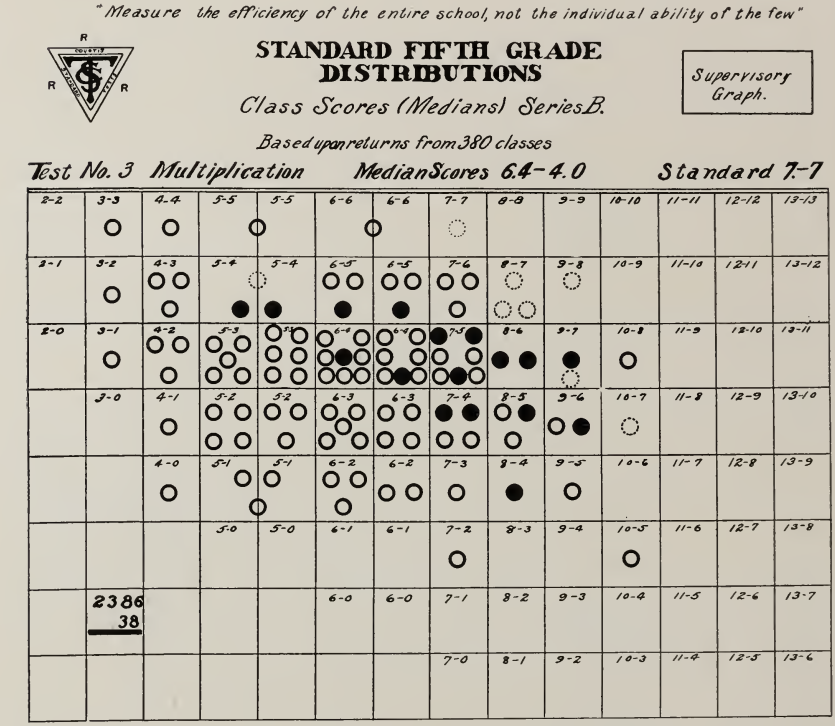

FIG. 23

had a score like that one (indicating). You see some of these better results here run away beyond the limit of the usual fifth-grade distribution, especially in their accuracy, not in their speed. Some of the teachers here still lack speed; but every teacher can see exactly how she stands. Now if tests are used as a tool, and if they are used by the teacher willingly, for her own guidance, if they are used from the proper professional spirit, there is no question but that the testing is of very great value; but if they are used as a club I will agree that they are of very little value.

For teaching it is not necessary to have carefully worked out or standard tests, as some people seem to think. A very great deal can be done under every subject even with the ordinary school examination, if the work is only carried thru in proper fashion.

For instance, here is a measurement of handwriting based solely on the teacher's estimate. We had seven children in this class rated by the teacher as excellent, eight as good, and the rest below. That gives an efficiency of about 15 percent. There is not very much change in efficiency until you get into these grades (indicating), and in here you have the problem of the elimination of some of the poorer children which accounts for the larger percent. How much change is being made in your handwriting by your handwriting work? Is it productive or not? This slide says that it is not, that the increase from year to year is less than 5 percent. Look at these classes, measured by the Thorndyke scale, three sets compared. If you rate their efficiency upon the basis of the number of children who write as well as quality twelve or better, you have 41 percent, 20 percent, and 40 percent. Why should we not measure our product in as definite terms as any other manufacturer? Our products are measurable and definite. Let us keep track of our work in an accurate fashion. Let us be as honest as other people in other fields of effort.

One further point and I am thru. I hear a great deal of protest in different places from people as to the time cost of this measuring work. Many superintendents will start in in an investigation in English composition, or handwriting, or spelling, or arithmetic, and apply tests; and about two years later make a report. Again you have a city like Boston. They tested sixty-six thousand children in three weeks. You have many superintendents carrying the work thru and getting the work back promptly to the teachers, so that the teachers get the results back as a direct guide in teaching. Now that is perfectly possible if the work is properly organized. A great many superintendents are not doing the work themselves. They have not the time. The person in charge of that work brings the principals of the different schools together and addresses them as a class. He gives them the test and drills them in the work in such a way that the principals understand by the actual doing of the work exactly what is wanted, so that they may give the test uniformly. Principals in the same way drill their own teachers, so that the teachers are uniform in the giving of that test from one end of the school system to the other.

Then at a given time and under the given conditions the tests are made.

For a great many of those tests, the work can be reduced to a basis where the scoring need not take more than two or three hours time. This means that if the test is given on Monday and the teacher works a half hour on each of the four succeeding days, the work would be completed on Friday. The result from the different classes would be gathered by the principal the following Monday; and the result from the entire school system would be complete in the hands of the superintendent in a week.

In Detroit, on Wednesday, May 12, we shall give about one thousand tests. By Friday night, barring unforeseen accidents,[1] those results will be in my hands complete.

Now the point I want to make is this; that this work is not a thing to be taken up as scientific curiosity, or as a fad, to be done once and forgotten. The thing you need to do is, in my judgment, to make a study of the training of your teachers for this type of work, by planning a careful organization of the giving and scoring of tests so as not to interfere with the regular work, and not to add too many burdens to those the teacher already has. You want to put the measurement thru on a permanent basis, making your plans not for one year or for two years, but for a permanent institution in school organization, related to the actual work of teaching so closely that the teachers may have the use of the results for guidance of their teaching.

If we can get things on that basis, then measurements would be used to control the product, and we can have a great deal of improvement in the efficiency of teaching; but if they are used simply as a chance activity, as a thing to be done for a doctor's thesis, or something of that kind, then it will not result in any effective work.

In my lecture tomorrow I will try to show how results from standard tests can be used by teachers to modify their existing practice in the classroom; and if you get the idea as I see it, you will understand why there are six and eight and ten school systems that have organized permanent departments of educational research, so that their school work may be consistently modified year after year, on the basis of the results secured.

A brief intermission followed.

[1] A street car strike prevented the finishing of the results in one school. The rest of the work was carried out as per schedule.

MR. MYERS: The round table is set for this time. The subject is "Limitation of Training". You will be led in this discussion by Dr. Courtis, Director of the Department of Educational Research in the Detroit public schools. After a brief statement by Dr. Courtis on the subject "Limitation of Training", the whole subject will be open for discussion. Ladies and gentlemen, Mr. Courtis.

ROUND TABLE ON LIMITATION OF TRAINING

MR. COURTIS: Mr. Chairman, ladies, and gentlemen, I am never sure that I make myself plain when I talk on this subject. In fact I am almost sure I do not, because I always find when I get thru that there are many misinterpret what I have said. I have a couple of charts here that I am going to hang up. While you may not be able to see them, yet I think the idea will be plain. I merely want to present this again for your consideration. I have put on this chart the reason for the present inefficiency, and in my judgment this is the fundamental reason why our schools are not more efficient than they are: At the present time we give practically uniform instruction to variable material.

This girl, for instance, has ability which I have represented diagramatically by ten, and this one by eight, and this one by five, this one by two, and this one by one. Now you know all children differ in their native capacity, and yet we give practically uniform instruction to all those children. As a result we get the only thing you can expect. We get a tremendously variable product. Five percent of the children, for instance, will attempt twenty-four of those addition examples I showed you, and twelve is the average score. It is possible to have them go as high as sixty. How high then shall we carry the product? How far is it desirable? My point is that there is a line somewhere in there, which I believe is located closely at thirteen or fourteen examples, beyond which it is a waste of effort to go. That is, if your training develops in a boy an addition ability which will enable him to complete, let us say sixteen or eighteen or twenty of those examples in the given time, every bit of that ability beyond fourteen is absolutely waste time put on the arithmetical drill. My point is that there is a lower limit and an upper limit, and that at the present time our products either go beyond it or away under it; and that in place of such a condition we ought to have a slightly different arrangement.

In this chart are the same children with different abilities, and this time, instead of having the instruction uniform we have the instruction graded in amount to correspond with the abilities of the children. That is, we supply variable training for variable material, and as a result we get a uniform product; in other words, it is all a valuable product. None go above this limit; no one goes under this limit. We get a product all of which is useful. That is, we get a hundred percent efficiency. We could produce those conditions, and to my mind the very greatest problem before educators today is the invention of a method of classroom administration that will permit of this kind of an adjustment for ordinary school subjects and with large classes of children. At the present time I can do it in spelling; I can do it in handwriting; I can do it in all of the mechanical elements of arithmetic; I can take a class of eighty children, for instance, and give every one individual instruction in accordance with his ability. I can allow each one to go at his own rate. I can eliminate him from the drill class when he reaches this limit. I can continue the training for the individual until he gets up at least to this limit. The limitation of training is perfectly possible under normal school conditions with large classes and many duties occupying the teacher's attention. Now how far is it desirable? How far are you superintendents and teachers willing to stand for this idea of limitation of training?

I should like to have from this conference this afternoon an expression of opinion on that matter. If you have any questions to ask, if I have not made myself clear, let us have those questions asked and answered first; or, if you have any comment to make, whether such an ideal is desirable or not desirable, I shall be glad to hear them now.

I will turn the matter over to you. I always feel this way: The minute this conference is dismissed, the minute you get by yourselves, I think everyone will have something to say about the results which you have seen. No person concerned with school work can thoughtfully review those data and not react to them. I think, in fairness to me, if you have any objections to anything I have said that you ought not to state those objections anywhere outside of this building unless you have first stated them here. That is fair, is it not?

You have heard what I have to say. Perhaps you have misunderstood what I said. My training in oral speech has not been very efficient. I find I cannot speak very plainly. People misinterpret what I say. They say I said the kind of things which I

did not mean to say at all, consequently if you have any objections please let me hear them.

The following questions were then asked Dr. Courtis by various members of the conference and answered by him as follows:

Questioner: What is to be done where the teacher has all she can do as it is, where her time is all taken up with her duties as things are?

Mr. Courtis: That is one of the most peculiar things I think that has come out of this whole work. I go to a teacher and I say, "Now we have decided to try this method in the system, and we have selected you to try this method experimentally." She says, "Have you seen my program? I am so rushed I don't know what to do. There is not time enough in the day now for what I have to do." "Well," I say "this matter is required; I am sorry; you will have to make this adjustment some way; will you please try it for two or three weeks?" and gradually she will give in and try it because she has to. At the end of three or four weeks she comes to me and she says, "I have five children who have already completed all the work set for the term; what am I going to give them to do?"

Now, is there no work in the school that is valuable to the individual upon which he can spend his time when he is released from this mechanical drill work? Are there no concrete definite problems which will involve initiative and development? Is there no use you can make of that time? I say the fate of the children is in the hands of the teacher. The wise teacher uses that time for work of one hundred times the value of the mechanical drill.

Questioner: The question is what happens after this skill is acquired.

Mr. Courtis: It is to be used. The drill work that is going on in school is not all the work. The drill work in arithmetic is not all the work in arithmetic in the school. He is using his addition in the solution of problems. The minute that child's accuracy or speed falls down anywhere along the line he goes back in the drill class. As soon as he comes up to the standard he comes out of it. It is training for a purpose. Would not the child see then what that drill was for? Would it not serve his purpose better in the school?

I went into a schoolroom not long ago where we had given an English test. There were fifty odd children and I said to the teach-

er—one of the normal school cadets was in charge of the class, so that the teacher was free—"I know you have fifteen children in this class who are very good writers, whose work in writing is perfectly satisfactory. In your opinion are they getting any benefit from this drill which they are having at this particular minute?" She looked at me for a minute and she said, "I never thought of that. I don't think they are. Their writing is already perfect, and has been for a long time." I said, "Why are you giving it to them then?" She looked at me again for a moment, she shook her head, and didn't say anything. I let that go, and said, "What about these other children? Have they any incentive to improve their writing? Will they ever escape from the drill class?" Again she shook her head. That was all she could say about it. That is the situation that prevails right thru your schools if you have a class that you are running on the plan of class drills. You give the children the drill whether they are good writers or poor writers. It is simply that at a certain time you come to a place on the program where you have writing, and you have writing. Eighty children out of a hundred need that drill, and need it badly, and for those that need it, provide the drill, but *set free* the children who do not need it. Set free the children it is not adjusted for. the children that have profited by it and do not need it. The real test of the writing is in the writing in English, history, spelling, and other lessons.

The minute you have the idea of limitation of training you say to the children, "This is the product which is desired from the writing drill," and you have created a new situation. The child has something to work for. When he gets up to standard he escapes from the drill class, and the minute he takes hold of his work and begins to do this oval, not because the teacher says the time has come to do the oval, but so that he will get thru with it and break the record, you have got on his part a conscious participation in the drill. You have aroused a desire for improvement which makes the drill effective. And if the child is set free as soon as he reaches the desired degree of ability in that work, there is a chance for him to spend his time on more important work, and you have that tremendous spur on the other individuals to drill for a special purpose. It works out splendidly.

QUESTIONER: Has that ever been worked out?

MR. COURTIS: We have it in operation in arithmetic with twenty-five thousand children in Detroit. We have had it experi-

mentally in writing. We have about fifteen hundred children trying it in spelling.

Questioner: What do you do with the other children?

Mr. Courtis: There is a time in the day, for instance, when fifteen minutes is allowed for writing drill for those who need it. Those who do not need it are set free for other things. If they have a soccer tournament it is the children who get free who go out and make the arrangements for it during that time. If there is a toy to be constructed, or mechanical work of any kind, the children are free to do that work. The children who have completed the mechanical drill have the time for other things for which there is occasion.

Questioner: What percentage of those set free does it become necessary to put back in the drill again?

Mr. Courtis: Not very many. Possibly one or two. After they find there is a penalty of that kind, they don't go back. The boy who completes the drill work for the term is a hero, and he doesn't like to have his laurels taken away from him and go back into the drill class again.

Questioner: It is a fact that the boy who does his drill work ahead of his class can do his other work ahead of his class, too, is it not?

Mr. Courtis: Not necessarily.

Questioner: Why not put him in another class?

Mr. Courtis: If you put him in a higher class you will very quickly get him into a type of work which is more abstract than his maturity and development fit him for. If you hurry a child thru the grades you get a twelve- or thirteen-year-old child into high school work, and you get him into a type of work which is beyond him.

Questioner: There are things easier to say than to prove. There are children more mature at ten years than others at thirteen.

Mr. Courtis: If you can show me by any tabulation that a child twelve or thirteen years old has had the experience in dealing with other people, has had the social and sexual experience, and has had all those other experiences which go to make up the equipment

which will enable him to study college history and other college subjects intelligently, why then I will——

QUESTIONER: I shall not try to do it.

MR. COURTIS: I do not think it is well to get the child into subjects that are beyond the maturity of his experiences, however able the child may be to go to the *form* of intellectual activity in those fields.

QUESTIONER: Is it not hard on those who are weaker, and never get out of those classes?

MR. COURTIS: Not at all. Here is the point of the thing. which I will try to show you tomorrow morning. The fundamental idea in this business is, to my mind, that every child has a right to have set for him, no matter what his age or grade, a task such that if he really tries to do it, he will be successful. You can measure the child before you begin to teach him, and you will find out what his ability is. If he is down at the lower end you do not set him a task he cannot reach. You set him a little baby task, and then a little larger, and a little larger task. Every child improves. If he does not gain it is the teacher's fault. It is not the child's fault.

I was interested in this chart on the wall. You have there the record of about three thousand children who were reported as failing, and the record by the teachers of the reason why they failed. The teachers said 16 percent of those children were mentally deficient. It looked very large, and we checked it back and it worked out about a standard of 2 percent. If you ask most teachers about a particular child they say he is lazy, dull, deficient, or something of that kind; but it is my personal opinion that there are many hundreds of children who are grouped in the deficient class who are really not deficient at all. There are some children whose minds are apparently so peculiarly constructed that they have just one door into them. There is a certain way of approach. If you try to approach otherwise you cannot get in. Imagine such children in the ordinary school with a teacher who is, say, a visually minded teacher, where method of instruction is entirely thru the eye. Say this child is strongly ear minded, or is motor minded, so that he understands only what he hears, or handles. You may find that all the classroom experiences are apparently meaningless to him, and you have the appearance of mental deficiency. Pile that up year after year and you finally create a mentally retarded state which is entirely real in its results but not necessary.

The other day we were trying a test on a kindergarten boy and the boy didn't follow instructions very well. The teacher said, "He is mentally deficient; he doesn't understand anything." I said, "His score in this test is all right. His fatigue factor is normal. He does not look like a deficient child. Have you tested his ears to see whether he is deaf or not?" She said "No." I said, "Do you know anything about the child at all, or his home conditions?" She said, "No." I met her about a week or two weeks after that, and she said, "I looked up that boy; and he comes from a family that is Dutch, and they talk only Dutch in the family; and the reason he doesn't respond is because he doesn't know what we say to him." How many such children do you suppose there are?

Do you see on the chart 30 or 40 percent either standing still in ability or going back while the school is trying to teach them? If you pick out any one thing, reading or handwriting, I can show you children that are being injured by the drill you give them, because they are not adapted to the drill, or the drill is not adapted to them. It is not one child, or two, but 40 or 50 percent that are standing still or going back, because you are not adjusting your methods to their particular needs.

That is why measurements are important. The time to measure is at the beginning of the teaching, not at the end. Measuring at the end is for our own satisfaction.

Questioner: Then you will have a great number of classes to teach, will you not, if you try to adapt the teacher to the capacity of the child?

Mr. Courtis: Why, no, tho it would seem so. That is one of the peculiar features about the whole situation. Suppose I have a class of seventy children, and suppose also I have a series of lessons of equal difficulty,—of graded lessons in arithmetic, additions. The first day every child takes the first lesson. Those who succeed in that lesson do not need that particular drill. The second day they go on to the second lesson. Those who fail in doing lesson one evidently need to work right there. Now if you take such a group, you will find that out of those seventy children, there will not be more than four on any one day that will need the teacher's attention. That is, twenty minutes of individual work will supply the attention required by seventy children. Having helped one particular child that child will go perhaps three or four weeks before the teacher needs to help that child again. When you get a diagnosis

of individual conditions you will find that all the teacher needs to do is to help, at certain spots, here and there, and by helping three or four children a day she can keep seventy children growing. But the teacher must have some means of selecting the four, and of determining the precise point at which those four need assistance. That is the function of measurement. Do I make that plain?

QUESTIONER: You would have sixteen classes a day.

MR. COURTIS: No; you do not understand me. Here are seventy people taking the drill. Out of that seventy there would be sixty-six capable of going to the next day's work without assistance. Four will need the attention of the teacher. She has to work with those four. Having helped those four, for two weeks after that they do not need attention. They will go on successfully with the regular assignment of class work; but the next day there will be four more who need attention, and the next day four more, and so forth. As a rule it will come out about that way. It may be eight on one day perhaps, and none at all the next day. But ordinarily the average teacher is able to handle all the children that need attention in a group of sixty or seventy. This is true for mechanical drill work, but not for reasoning work, not for emotional and inspirational work. In work of that type small groups are necessary.

Are there any other questions? Are you willing to accept the idea of the limitation of training? You are a very unusual lot of superintendents if you do. Are you willing to say that here is a boy who has reached an ability of twelve examples in addition; if I continue training him he will reach twenty-four by the end of the year. Are you willing to say he does not need to develop beyond twelve in addition? Are you willing to stop with his handwriting drills when you get a child up to quality twelve or better on the Thorndike scale? Such willingness must be the result of the investigations you are carrying on. Most superintendents do not see it. What! Limit a boy's training! And yet that is precisely what you are doing anyway, because if you gave your whole time to training in addition you could get a boy up to sixty or seventy examples. You are going to cut it off at some level. Why not determine the degree of ability that is essential, and having found it, define it? Notice, if you agree to that doctrine, agree that it is a desirable thing to do, then it becomes the duty of every one of you to go right back home, and, for the guidance of your teachers, write into your course of study the precise degree of ability necessary in each one of these mechanical skills, does it not?

QUESTIONER: What do you mean by ability—do you mean ability in speed or accuracy?

MR. COURTIS: Both. Speed and accuracy are two separate abilities.

QUESTIONER: What is the upper limit in accuracy?

MR. COURTIS: One hundred percent.

QUESTIONER: And what in speed—twelve out of twenty-four?

MR. COURTIS: There is no limit to human ability in speed. I have people who can do sixty of those examples in eight minutes. There is no upper limit. If you take even a mature, practiced individual and give him further special practice you can get his scores to rise. If you change the condition of practice, you will find another rise and another plateau. That thing has been done repeatedly.

QUESTIONER: Then speed must always be one hundred percent. If he solves one problem it must be with one hundred percent accuracy, and if he solves two it must be with one hundred percent?

MR. COURTIS: Because accuracy is the result of training.

QUESTIONER: Why limit their speed?

MR. COURTIS: Because their time can be used to much better advantage in other subjects than it can in developing unusual degrees of speed in relatively unimportant abilities. We are doing so much in school where the teacher does the work and the children follow. What we need is men and women who can take another man's problem and work it out; who have the power to take a problem, analyze it, get it into its elements, and solve it; how can we gain that kind of training if the teacher is always saying "Do this this way, and that that way, and the other thing the other way," if the children never take the problem and work it thru of themselves?

Suppose a boy has brought himself up to the required standard in any one of these mechanical drills; it would be perfectly possible, if you have a heating and ventilating system in your school,—take the heating in the room, for instance. Say this hall has a capacity for a certain number of boys, or people, and ask him to find out whether the heating arrangements are adequate for a room of this size, according to the standard or not. He will say he doesn't know how to find out. Tell him that is part of the problem. Sup-

pose that he goes to steam fitters, to engineers, and to various people, gathers in that information from day to day, and simply reports each day to his teacher some progress? Would not the teacher have brains enough to judge whether he was doing it successfully or not? The drill problem is the poorest problem for him to work at. Is there not other work more important than for him to learn to add when he already does it faster than the ordinary child of his age?

QUESTIONER: Does it not depend on what he will do when he gets out of school?

MR. COURTIS: It doesn't make any difference what he does in later life, for he will have to solve problems; and the supreme thing in education, as I see it, is to teach people both how to handle a general method and how to keep their poise and balance as they are working with problems. You can gain a kind of training in working out the problem of the heating capacity of this room that is transferable to any problem you can give him to work at. You want to make the general method conscious. When a child fails, point out to him *why* he fails, if you can, and much of the difficulty is overcome. Ordinary training does not transfer, but conscious control method does transfer.

QUESTIONER: Would you regard the working out of the heating capacity required for this room a problem for a fourth-grade boy, or what kind of work would you use for a fourth-grade boy?

MR. COURTIS: No, sir; I would give a fourth-grade boy a task according to his age.

QUESTIONER: I have seen second-grade pupils do most additions, all possible additions in the second grade, with ease. Now it is not a question of brains with teachers. They have plenty of brains and they use them with pretty good effect; but I hold that that is not a valuable way of spending time, for a boy who is up with his lessons. I would think it would be a waste of time for him to run around bothering architects and engineers and bothering the laboratory and bothering himself trying to work out the heating capacity required for a room.

MR. COURTIS: I simply used that as a poor illustration.

QUESTIONER: It is a poor illustration. I want to know some of these things that the teachers in our school work can supply in-

stead of these drills, as they are termed, to take up the surplus time. I have them do it by having them put the children in higher classes, and they do the work.

MR. COURTIS: I will tell you the kind of thing that will come in there, a real problem which they will feel an interest in. If you give him printed instructions for the making of some toy which he could use in his own play it will answer very well.

QUESTIONER: That is an old scheme that has been worked threadbare, this business of making toys, bread boxes, and things of that sort.

MR. COURTIS: If you hold him down to the making of them absolutely without help from the teacher, absolutely from his printed instructions, you will develop him in a very valuable way.

QUESTIONER: We do that at other places; in the manual training schools they do work of that kind. You are trying to lug in work that is already provided for in the course of study, and by teachers who are trained for it, and to have our teachers——

MR. COURTIS: No; I am working for a product which is not attained now by the work in the schools. There is no place now in your school where the child has the time and opportunity to struggle with a problem unaided. If he goes into the manual training schools his manual training teacher must get results, and she gives such precise instructions that she removes most of the problems involved in the task.

QUESTIONER: You are mistaken about that.

MR. COURTIS: There are many cases where that is done.

QUESTIONER: Yes; but that is not the rule. That is not generally true.

MR. COURTIS: The next step in a method of that kind would be a set of problems which could be handled in the classroom, which would be definitely related to the life of the child. If you don't like that part of it, I would say he could use his time for whatever work you would consider most advantageous to the child.

QUESTIONER: Put him in a higher class.

MR. COURTIS: No, sir: I would not accept that. I would take work in that child's life. Reading if you like, or——

QUESTIONER: But what?

MR. COURTIS: Why, anything which involves working out and using the skill which he gets in the classroom.

QUESTIONER: It is easy enough to say anything. What, for example? Don't take time to answer that; but it is using your time to poor advantage to say "anything".

MR. COURTIS: I have given you my specific answer, in my judgment. I may be wrong. As far as I have seen it work we have always found that the play element gives us a training in three or four different directions. For instance, when we were working with those fractions, I showed you that the children that completed that test were allowed to go into the school store and do actual business in the store, which was to them a gain. Now in that store they did actual work which involved the same activities as those of the drill class; and by keeping up our work correlated that way we got along without any trouble.

QUESTIONER: Do not get the notion that I am antagonistic to you. I am not. I believe in it, but I want to ask you these questions and have them answered thru you, for the questions are questions that have been submitted to me and I couldn't answer them.

QUESTIONER: Who had the oversight of these children that were permitted to go out of the drill classes?

MR. COURTIS: Those children who are able to get thru went down into the storeroom. We had one of the clerical assistants of the school, whose office was in that same room, give them some attention. They were allowed to play at that store provided they did not by their play disturb others; and the work was laid out for them in a very definite way, and they worked there without direct supervisory control; but they had the results to show. They had their sales slips, they had their accounts, they had to make things balance and bring in results. The teacher at the end of the day could look over it and see whether their work balanced, and whether it checked up with the check book. The checking was a small matter.

Another thing is in preparation for next year; as we get the children out of the drill work, we have them take up additional regular work in the subject, the optional work in the course.

Questioner: Carrying that idea out in its full meaning, the same type limits would be reached in other subjects, and there would be the same variety of work to be supplied in each of those.

Mr. Courtis: Yes, but please do not misunderstand me. It is very easy to get up and talk about a thing that you are just working on as tho it were a finished product. It was not until two years ago that we discovered what was the real factor in teaching effort. Up to that time every single effort that I made to improve my own methods as a teacher made the results worse, not better. As I put on extra pressure, or extra drill on this, that, or the other thing, I made my distribution within the class widen, some children going up and some going down. It was not until we got hold of this thing of adjustment to individuals that our classes began to go together; and it was not until we got some children who were set free from these mechanical drills that we began to get results. The important problem is to work out a series of definite exercises,—toys, I should say,—which we can put into the hands of the children for them to work out as they get thru these drills, this mechanical work. Because the teachers haven't that material now, we set the children free for work on the subject on which they have the greatest need to work. It often happens they may be very poor in spelling, and they may need extra time there; if so they are set free to take the time for that purpose.

Questioner: Why not allow the children to suggest what they would like to do? In many cases I think that would help out considerably. Get the boy who got his work out in shorter time than the others to suggest something he would like to do.

Mr. Courtis: There is a problem there which needs the whole of this group working on it to solve.

Questioner: Would it not be natural for children to say, when they reach that standard, we will quit? Then we are confronted with the possibility that we might be putting a premium on mediocrity. The child would say, "When I get there I will quit." Don't you think there is a possibility of that, doctor?

Mr. Courtis: No; not if you see things as I do. I see the mechanical elements of school work as tools. Everybody uses the same telephone from New York to San Francisco, practically. The difference in the instruments is very slight. It does not affect the personality of the individual any. It does not make for mediocrity.

If we get everybody so that they can write and read and compute at the standard rate, and then we give them problems in which their personality will come into play we make a difference which is important. We make it possible for these people each to make his own contribution to the work of the world. The uniform product in mechanical skill is simply a means to an end. It enables people better to do their work. Now the child that can do twice as well as another in addition is not necessarily able to make any larger contribution. The real contribution comes when you work on a problem where you have a motive behind it, where you are using addition as a tool.

QUESTIONER: Carrying your plan out to its ultimate completion, it means ultimately the reorganization of our schools?

MR. COURTIS: Absolutely.

QUESTIONER: Here is one teacher who will perhaps have subjects in which she will handle seventy or eighty children, and other groups of fifteen or twenty, and it will mean practically the death of our fixed grades, will it not?

MR. COURTIS: Certainly. The grade in my judgment is a certain type of ability. A person who can do three additions in that test in addition is third-grade ability, whether he is ten or sixty years old. It does not make any difference when a person gets there. His grade will be determined by the performance which he has made.

My conception of the future school is like this: You will have a large central assembly room, like a library, in which all forms of drill work will be carried on at the same time. Each child, by proper adjustment of the work, will work on the task which is suited to him. But around that, on a lower floor, you will probably have a number of small rooms—I always think of them as educational confessionals. In charge of those rooms you will have teachers of marked ability, of special training, of higher salaries, who will handle the children one at a time, and will write a prescription for the type of work they must take in the drill subjects to overcome certain defects. Now as they get out of that drill work, as they reach certain levels, they will go to the second story where the work will be organized on the basis of the children's own interest. It will be play or work—I don't care what you call it. If the boy wants to make an electric motor and works at it six or eight hours a day in vacation, that is all right. Some people would call it play,

some people would call it work. I do not care which term you apply to it. I would like school work in history and geography, and the school work in every subject, wherever there is knowledge or an inspirational element, to be of such a character that the child would take part in it because of his own satisfaction and his own interest in the work he was doing, because he wanted to do it; and for that we will have to have large laboratories where the children could enter the work in groups. There would be distinct training in the handling of such group training in leadership; and you would have all training by the direct participation of different individuals in organizing problems in handling those groups. If you could have your school on that basis the mechanical work would be largely on an individual basis, the cultural and inspirational work with small groups in charge of trained specialists who were free to do their work in the most entertaining way possible and to arouse all the emotions possible for that type of work. Then I think you would find an entirely different type of product coming out of our schools.

Questioner: Suppose I say I am ready to go home and begin to write these things in my course of study for my teachers; I am not sufficiently assured right now of all the little ins and outs to know what standards are to be set; where can I get the help that I need?

Mr. Courtis: You will find in the 14th Year Book of the National Society for the Study of Education, University of Chicago Press, a list of the standards which have been set so far, and you must begin to work out standards yourself. Suppose you want to consider products for which there are no standards, you would have to make up your own type of examination, give it out to your classes, set a standard on the basis of your results, and then begin to experiment with it and see whether it was reasonable or not.

I got into this work because I tried to set standards for my own work. I set my standards away up here some place (indicating), and I reached those standards by some effort; but I fortunately came into contact with Thorndike, and he taught me to watch the scores of individuals. I found a certain group of these individuals were running this way (indicating); and I found during vacation they dropped from this high level down to about the ordinary level; and so out of that work finally came the idea that I needed to measure a larger number of people to get my standards. Certain of these superintendents have helped me get the measures of those children, so that now we know that children in this coun-

try and other countries, under a given amount of training, do about the same amount of work. Just read the tables you have from your own work here in Indiana. See how uniform those products are compared with the range of individual scores. Human nature generally has about the same ability, evidently, that is, there is probably a certain optimum ability people can reach in these mechanical skills, and the figures show very plainly that if you train beyond that you get a diminished return for your effort. If you double the time you don't get twice the result. If you treble the time you don't get three times the result. You get a diminished result, and get a larger loss during vacation. There is a certain optimum value, and that value I think is represented in those standards which we have set.

I am perfectly willing to change those standards as soon as any of you can prove that it is wise to change them. I am not going to change them blindly. I know that those speeds are the speeds at which most of the children work, and I know that further training will improve the accuracy but not the speed, at least not much. Consequently I have adopted those tentative standards for my own work, and my problem at the present time is to work out a statement somewhat like this: That one hundred hours training under such and such conditions ought to produce in the child a change in the score equivalent to, let us say, six examples. When I can state definitely what the change is, and what the elements are then I am ready to set up final standards; but until that time comes we must have something as a working basis; and that will be found in those standards in a book to which I refer.

FRIDAY EVENING SESSION

The conference was called to order by President William Lowe Bryan, Presiding Officer for the evening session.

PRESIDENT BRYAN: The teachers of Indiana are very glad to welcome Mr. Leonard P. Ayres, Director of the Division of Education, Russell Sage Foundation, who will now address you on "Making Education Definite". Ladies and gentlemen, Dr. Ayres.

MAKING EDUCATION DEFINITE

MR. AYRES: Eighteen years ago the school superintendents of America, assembled in convention in Indianapolis, discussed the problems then foremost in educational thought and action. At that meeting a distinguished educator—the pioneer and pathfinder among the scientific students of education in America—brought up for discussion the results of his investigations of spelling among the children in the school systems of nineteen cities. These results showed that, taken all in all, the children who spent forty minutes a day for eight years in studying spelling did not spell any better than the children in the schools of other cities where they devoted only ten minutes per day to the study.

The presentation of these data threw that assemblage into consternation, dismay, and indignant protest. But the resulting storm of vigorously voiced opposition was directed not against the methods and results of the investigation, but against the investigator who had pretended to measure the results of teaching spelling by testing the ability of children to spell.

In terms of scathing denunciation the educators there present and the pedagogical experts, who reported the deliberations of the meeting in the educational press, characterized as silly, dangerous, and from every viewpoint reprehensible, the attempt to test the efficiency of the teacher by finding out what the pupils could do. With striking unanimity they voiced the conviction that any attempt to evaluate the teaching of spelling in terms of the ability of the pupils to spell was essentially impossible and based on a profound misconception of the function of education.

Last month in the city of Cincinnati that same association of school superintendents again assembled in convention, devoted

fifty-seven addresses and discussions to tests and measurements of educational efficiency. The basal proposition underlying this entire mass of discussion was that the effectiveness of the school, the methods, and the teachers must be measured in terms of the results secured.

This change represents no passing fad or temporary whim. It is permanent, significant, and fundamental. It means that a transformation has taken place in what we think as well as in what we do in education. It means that education is emerging from among the vocations and taking its place among the professions.

This profound change in our educational practice has not come thru the slow processes of philosophy, or because we were awakened by the stirring words of voice or pen of any educational prophet. Few school men can claim great credit for having hastened its advent. It was forced upon us, first, by the natural results of compulsory education, and still more definitely and directly by the exactions of the scientific age in which we live.

This new attitude of educators towards education means that we have ceased exalting the machinery and have commenced to examine the product. We have awakened to a startled realization that in education, as in other forms of organized activity, applied science may avail to better even those processes that have rested secure in the sanction of generations of acceptance.

The transformation now taking place in education means that it is our privilege to be part of a movement that is working changes comparable to those that are now remaking almost every form of industrial activity. The trade of bricklaying, practiced by millions of intelligent artisans, has remained almost unaltered since the days of primitive man. But scientific management steps in and asks, Why lower a hundred pounds of human flesh to pick up each two-pound brick? Why toss the brick four times to find its best face? Why tap it three times to get its proper level? Why stand in a position that requires half a dozen movements when one will suffice? And science makes answer: Build a platform for the bricks adjusted to the height of the work; lay the bricks on the platform with the best face out; mix the mortar so that one tap will suffice; and take such a position that five movements accomplish the same results that formerly required eighteen. The result is that each workman lays each hour as many bricks as he formerly laid in three hours.

Again there is the work of Mr. S. E. Thompson, who used reaction-time tests in selecting girls for the work of inspecting for

flaws the steel balls used in ball bearings. This work requires quick and keen perception accomplished by quick responsive action. Mr. Thompson measured the reaction-time of all the girls and eliminated those who showed a long time between stimulus and reaction. The final outcome was that thirty-five girls did the work formerly done by one hundred twenty; the accuracy of the work was increased sixty-six percent; the wages of the girls were doubled; the working day decreased from ten and one-half hours to eight and one-half hours; and the profit of the factory was increased.

The ideals and processes of the application of the scientific method to education are in salient respects similar to those that are reshaping the processes of industry. In education, as in industry, the scientific idea is at base analytic scrutiny, exact measuring, careful recording, and judgment on the basis of observed fact. Swiftly, silently, and almost without warning, the scientific methods have invaded the educational camp and have begun to demolish the hosts of theory, legend, superstition, and tradition.

The time has already passed for us to query whether or not we shall endorse and adopt the new scientific criteria of exact measurement and judgment by results. The new method is upon us, and the question at issue is no longer "Shall we adopt it?" but rather, "How shall we utilize it?"

In dealing with the application of the scientific method to education and to industry, we must ever bear in mind one fundamental distinction. This relates to the use of time in these two sorts of activities. Time is the most important thing in the world. It is the one ever-present factor in all human accomplishment. Each thing that we do or make includes two elements: the time consumed, and the result obtained. In dealing with these two elements, the problems of education are fundamentally different from the problems of industry. In industry the tasks to be done are always definite tasks. In commerce, transportation, and manufacturing, the problem centers on the amount of time necessary to sell goods, to carry people or things from one place to another, and to manufacture articles. The result to be obtained is a constant; the time required to do it is a variable.

In the field of education all this is reversed. We have a given amount of time, and our problem is to spend it as best we can. So far as elementary schooling is concerned, this available amount of time is about eight years. It begins at about the age of six, when the child becomes comparatively independent of his mother,

and extends to about that of fourteen, when physical maturity approaches. These are biological, rather than educational, facts. During these years, going to school is the normal as well as the customary occupation of children.

The distinction indicated is the reason for the striking contrast between the signal progress made in economy of time in industry, and the modest achievements in economy of time in education. In industry the results to be achieved are known, definite, and constant, while time is a variable. In elementary education the time to be consumed is a constant, while the results to be achieved are the variables.

In apportioning the eight years of childhood among the subjects of the curriculum, educators have always asked two questions. These are: "How much time should we devote to the subject?" and, "What results ought we to expect to get?"

The proposition that I wish to present is that we shall secure economy of time in education only when we realize that the amount of time at our disposal is a constant, change our inquiry from the indefinite to the definite, and instead of asking, "What results might or ought we to get?" begin to ask, "What results are we getting?" This means calling a halt on the futile quest for standards to be evolved at round-table discussions and educational faculty debates, and substituting for them methods of measurement and standards of attainment which are the products of recorded experience. If we can do that, we can lift our problem out of the field of speculation and into that of evidence.

Five years ago twenty-nine cities in America had systems of individual record cards for keeping the school histories of their children. Today over three hundred cities have adopted a uniform system for this purpose. Those cities intend to judge processes by results.

Three years ago the number of city school systems having uniform records of accounting whereby the school facts of one locality could be compared with those of another was about fifteen. Today the number of such cities is one thousand thirty-nine. Their aim is a mutual comparison of results.

Ten years ago Superintendent Maxwell of New York City published data in his annual report showing that thirty-nine percent of the school children of that city were above the normal ages for their grades. Judged by the age standards, they were educational misfits. At that time these data were almost unique and attracted widespread attention because of their revolutionary character.

Today such methods of checking up the results of our school work are commonplace.

These nation-wide changes are not products of mere chance. They have come because the public and the educators have begun to demand real information about their public schools. About seven years ago it occurred to a few people in America seriously to ask the question, "What proportion of the children who enter our common schools remain to complete the course?" This was a plain business proposition. The question at issue was the relation of the finished product to the raw material. The children who enter our public schools in the first grade are the raw material; those who complete the course and graduate are the finished product. It was an elementary question in business administration that these students were asking when they inquired what proportion of the children complete the common school course.

In order to answer this question, we must have two figures. First, the number of children who graduate. That can easily be ascertained in any school system. Secondly, the number of children who begin school each year. That cannot be obtained so easily. Incredible as it may seem, up to seven years ago school men had never thought it worth while to record that datum. A patient search showed that the cities in America recording the number of children entering school each year could be counted on the thumbs of two hands. Today the number of cities keeping such records runs into the scores.

At that time the school superintendents knew little more about the matter than that the beginners were numerous; that progress was not uncommon; and that there were some graduates each year. Now they know that in the country as a whole not one-half of the children who enter the public schools remain to graduate, and they are busily at work remaking their school systems to remedy that condition.

The startling revelation that our vaunted system of free education was failing to give even complete elementary schooling to a majority of the children evoked imperious demands for more real facts. Here were statements of educational conditions within the comprehension of all and painfully obvious in their significance. They left no room for question as to the necessity for checking up results in education.

The school children are the invested capital of the community. What should we say of a bank that kept its accounts in the same way that the school has kept account of the invested capital of

society? What would you say if your banker should confess that the only facts revealed by his books were the total number of accounts handled during the year and the average monthly assets? What would you say if he should confess that he did not know and could not find out anything about the number or amount of new accounts received, old ones withdrawn, or the results of his investments?

Nor was this situation confined to elementary schools. Conditions in our higher schools were even more shocking. The relation between the pupils who entered and those who finished was startlingly small. We can hardly imagine an analogous situation in any commercial industry. What, for example, should we say of a four-act play in the theater where a thousand people were present at the beginning of the first act, five hundred got up and left before the beginning of the second, two hundred and fifty of these refused to sit thru the third, and only one hundred and twenty-five remained to see the final descent of the curtain? And yet these figures express conditions in many of our larger cities with respect to the falling out of pupils in the four years of our high school courses.

The new method which judges processes in terms of results has been by no means confined to the development of record forms and the perfecting of new devices in the statistics of school administration.

About five years ago a graduate student in one of the universities of Massachusetts tried to investigate the old problem, "What is the best age to send a child to school?" In his search for information he put the question to the head of every college department of pedagogy in this country. He received definite and positive replies from almost all to the effect that the best entering age is a comparatively late one. He then followed his first inquiry by a second in which each pedagogical expert was asked on what he based his assertion. In every case save one the answer was that the writer was positive of the correctness of his views, but had no evidence with which to substantiate them. The exception was a man who said that he knew because his own son had entered school late and had made good progress.

This happened only five years ago, and the answers were speculative and indefinite because quantitative evidence bearing on the problem did not exist. And yet so rapid is the progress that has since been made that there has been published a study of that problem based on the school histories of more than 25,000 children.

From a Michigan city there comes a striking illustration of the degree to which we as educators have enjoyed that freedom which comes thru being entirely unhampered by facts. About seven years ago a movement gained headway in that city for the establishment of kindergartens. The advocates of the proposed innovation gave as their most weighty argument the assertion that children who pass thru the kindergarten subsequently complete the elementary grades in less time than do those who have not enjoyed the advantages of such training. The faction opposing the establishment of the kindergartens denied the validity of this argument. To settle the question, the school authorities wrote to school superintendents all over the country asking whether children who had gone thru the kindergartens subsequently completed the work of the grades more quickly than did those who had not received such training. Replies were received from the superintendents of seventy-two cities. Of these, forty-nine answered that they thought that children having kindergarten training subsequently made more rapid progress than the others, but that they did not know. The other twenty-three replied that they held the opposite opinion, but that they did not know.

That result was typical of the supremacy of speculation over evidence in education. In this problem, as in other problems, opinions have varied. There has been a consensus of belief but there has been an almost absolute absence of definite knowledge. Kindergartens have been increasingly numerous in America since Elizabeth Peabody established the first one in Boston in 1868. They now exist by the thousands and on them we have spent each year hundreds of thousands of dollars. During the entire period a favorite argument in their support has been the one relied on to secure their establishment in the Michigan city, and yet until recently no one has been able to state in definite terms anything about the real effect of kindergarten training.

This situation no longer exists, for within the past three years extensive investigations have been conducted comparing the school records of many thousands of children who have had kindergarten training with the school records of the children in the same systems who have not had kindergarten training.

The new scientific method has not been confined to the investigation of isolated problems. In city after city across the country its aid is being invoked to evaluate educational results thru the medium of the school survey. Unheard of only a few years ago, these city-wide educational inquiries have been made, or are in

progress, in such cities as Boston, Baltimore, Boise, Montclair, Orange, New York, and Cleveland. Already they are being planned for in other localities, and surveys embracing the systems of the entire States of Wisconsin, Ohio, and Vermont have been completed.

The progress of this educational revolution has been stoutly contested and each forward step has been greeted by an anvil chorus of opposition in which the notes ranged from the grudging admissions of the skeptic to the fiery denunciations of the educational reactionary. Always retiring and always fighting, these forces of opposition have abandoned as untenable their contention of fifteen years ago that any and all attempts at measurement in education are silly and dangerous. Having given up this position, they next took refuge in the firm declaration that while material matters in education may be quantitatively investigated, the immaterial problems of the teaching process can never be submitted to such treatment. They admitted that it would probably do no harm to discover the more important facts with respect to financial expenditures and the progress of pupils, but firmly declared that no phase of intellectual phenomena would yield to statistical analysis.

No sooner was this doctrine fully formulated than there appeared a set of scientific students of education presenting measuring scales with which to gauge the performance of the children in their classroom work. Thorndike with his measuring scale for handwriting, Stone and Courtis with their standardized tests in arithmetic, and Hillegas with his method for measuring the quality of English composition again forced the champions of tradition to retire and find a new point of defense.

Some three years ago, we undertook in the Division of Education of the Russell Sage Foundation two simple experiments in testing the social value of the subject-matter taught in our schools. The results were not conclusive, but they are most suggestive.

We had been asked to make tests of the arithmetic and geography taught in the schools of one of the large New England cities. Our experiments were confined to the work of the seventh grade. Turning our attention first to the arithmetic, we found that the work assigned for that grade was devoted mainly to measurements of space, time, content, weight, etc., and was divided into ten sections. We chose one example from each section, made from them an examination paper of ten questions, and submitted it to ten successful business and professional men in New York City, with the request that they take the examination. Those men

were earning yearly salaries ranging from three to fifteen thousand dollars.

After some protest, all of them complied, and tried to answer the questions. The man who made the best record was Owen Lovejoy, secretary to the National Child Labor Committee, and he succeeded in getting a mark of twenty-five percent. We then gave the same examination to our office girl who was fifteen years old and had left the eighth A grade of the New York public schools five months before. She got seventy-five percent.

The clear lesson of this little experiment was that the schools were teaching arithmetic that had little application to the work of real life. Each man who took the examination earnestly explained that he had known all those different measures once, but that as he had never used them, they had slipped from memory. Two of the questions related to the purchase of paper in wholesale quantities, and of the men who took the examination one was the business manager of a great national magazine, while another was the president of one of our foremost book publishing houses. Both of those men purchase tons of paper every year, and both failed on those two questions and protested that the terms used in them had been obsolete for half a century.

For testing the geography, a different method was tried. The work assigned by the course of study related in the main to Africa and South America. A tabulation of the amount of space devoted to the two countries by the textbook in use showed that Africa was given twice as much attention as South America. This suggests the query whether or not the Old World continent is more important to Americans than the New World continent. As a step toward answering it, figures were secured from the federal government showing the amount of commerce in exports and imports between our country and each of the continents. These figures show that the bulk of our commerce with South America is about eight times as much as it is with Africa.

As a second test, two press-clipping bureaus were asked to send us for the space of two months news articles and editorials dealing with either continent, and collected from publications printed in all parts of our country. The result was the collection of something like a bushel of clippings. When these were tabulated, it was found that those pertaining to South America were several times as numerous as those about Africa.

The result of this investigation was to show that there existed only the remotest relation between the amount of teaching devoted

in that school system to the continents and their countries, the frequency with which the ordinary citizen finds references to them in current literature, and the amount of business that we, as a nation, do with them.

More recently we have conducted another test quite unrelated to those just described. It consisted of a study of the spelling vocabularies of two thousand business and personal letters. The results showed a striking discrepancy between the list of words used in the letters and those found in our school spelling books. More than two-thirds of the words in the National Education Association spelling lists did not appear even once in the tabulations of the words of these two thousand letters written by two thousand different people.

A study of the penmanship of children in the final grades in different cities shows that at the end of eight years of schooling children in some cities are able to copy simple written matter at the rate of five words per minute, while in other cities children copy the same material in fully as high a quality of handwriting at the rate of twenty words per minute. Moreover, these discrepancies are found to exist between cities where the time devoted to the teaching of the subject is approximately the same. These are data from which satisfactory results may be distinguished from unsatisfactory ones. The new method of judging handwriting by measuring the work of the children is not so easy as the old method of doing it by discussing the methods of the teacher, but its results are far more definite.

In applying this method, we must keep uppermost in mind the fundamental principle that great economies are effected thru small savings. The change which effects a saving of thirty-five minutes a day results in economizing one year of school life out of the eight-grade course. The change which saves three and one-half minutes per day means the saving of one school month during the course. It is the small changes that produce the big results.

No claim of finality or completeness can be made for these obviously inadequate tests of the social value of the arithmetic, geography, and spelling taught in our school systems. What has been presented is offered merely as illustrative of the sort of tests which might be made to evaluate the social utility of some parts of the subject-matter taught in our public schools.

The final citadel in which the old guard is now making its last stand consists of the objection that the most important elements of true teaching can never be measured.

They assert, and they are right in asserting, that we can never determine by mathematical measurement the degree to which the strong man and the noble woman influence for good the characters of their pupils. But what they overlook is the fundamental truth that in education, as in other pursuits of life, character and efficiency go hand in hand. As school executives make practical application of the newer scientific tests, no fact stands out with more impressive distinctness than that the teachers whose classes make the best records are the teachers who are the most truly successful in the shaping of character.

There remains one other objection, less frequently advanced but sometimes voiced, and that is that the advocates of the scientific method aim to reduce all work in education to the dead level of uniform precision. This charge is born of a complete misunderstanding of the ends, aims, and processes of the new method. Its aim is not uniformity but individual development. The measured beat of the concert recitation is not music in the ears of the scientific students of education. The sight of a rigid row of reciting children with toe tips nicely adjusted to a line painted on the classroom floor does not cause their souls to leap in admiration. Their ideal of school discipline does not consist of having a roomful of growing children accomplish the amazing feat of sitting thru an entire period without moving a muscle or winking an eye. Their ideal of educational administration does not contemplate a uniform country-wide daily program by which each recitation period in every city and hamlet shall be fixed by a master clock located at the seat of the national government in Washington.

The object of the new method is the substitution of evidence for opinion and knowledge for speculation. Its champions are working to develop measurements in education because they realize that only by this method can education become an art and a science, and its practice be changed from a vocation to a profession. They scan the history of science and remember that thru the development of measurements astronomy grew out of astrology, chemistry emerged from alchemy, and physics developed from mystery.

They read the history of education and realize that the astonishing progress of the past decade has come from shifting the form of inquiry from asking, "What results can or might we get?" to "What results are we getting?" This makes the pupil and not the teacher the center of interest. It calls a halt on the futile

quest for standards of attainment on which we have never come to an agreement, and aims instead to discover units of measurement. Simple as it sounds, this change from asking, "What results should we get?" to "What results are we getting?" is the keynote of the whole scientific method in education. To answer the question in its new form means the development of units of measurement, and when these are secured, the standards of attainment will work themselves out automatically.

The certainty about the scientific method in education is that it is with us. That it will develop enormously in the immediate future is entirely sure. What its effects will be we can as yet only surmise. The dangers involved are as real and imminent as the advantages are self-evident. These dangers will arise from the mass of superficial and erroneous results that will certainly be presented to the educational world in the guise of scientific contributions to applied pedagogy. What is to be our attitude toward each new contribution?

My own answer is that we must welcome them all, but challenge them all, and attempt to verify them all. Every figure, every process, and every conclusion, whether presented by the educational expert or the novice, must be submitted to the most rigid scrutiny and searching analysis before being accepted as worthy of inclusion in the new pedagogy.

In proportion as we are thus enabled to retain the genuine and to reject the spurious, education will move forward among the other sciences. Its new methods will substitute knowledge for speculation and evidence for opinion. Its marshaled facts, expressed in definite terms, will demolish the hosts of legend, superstition, and theory.

Under the new régime the studies to be included in the curriculum and the methods by which they are taught must have a more valid reason for being than the fact that our forefathers had them in their schools.

"How much?" and "How many?" and "With what results?" are going to displace guess-work, imagination, and oratory as criteria for shaping educational policies. The old method has been education within the sheltering walls of the cloister in which an occasional peep-hole has been cut to satisfy the parents and silence the taxpayer. The new method proposes education in the open and under the clear and penetrating rays of the searchlight.

SATURDAY MORNING SESSION

The session was called to order by Linnaeus N. Hines, Superintendent of the Crawfordsville schools. He introduced Associate Professor H. G. Childs, of Indiana University, who read a paper on "A Brief Survey of Problems in the High School Field".

A BRIEF SURVEY OF THE PROBLEMS IN THE HIGH SCHOOL FIELD

Mr. Childs: Mr. Chairman, ladies, and gentlemen: The two most significant factors in the educational situation at the present time are: first, the unprecedented growth of the high school in attendance, teaching staff, expansion of the courses of study, and equipment; and secondly, the rapid spread of the movement having for its object the measurement of educational achievement, the standardization of educational plants, equipment, and products.

Statistics from the reports of the U. S. Commissioner of Education, combined with estimates for the past year, indicate an increase in high school attendance of about one hundred and fifty percent since 1900. It is estimated that during the present year about thirty percent as many pupils entered high school as entered the elementary school. In 1900 the proportion was about one to ten. Never before have the people of any nation appreciated the possibilities of secondary education as do the American people at the present time. The extensive modification of high school courses of study in the past fifteen years, especially the introduction of the social sciences, commercial subjects, and the practical arts, has been a potent factor in high school growth thru its appeal to popular imagination and to the individual needs and interests of children.

The cost of secondary education has increased even more rapidly than attendance itself, and the public, tho generous in its expenditures, is beginning to demand an accounting—a justification for these ever-increasing outlays. Nor are these public demands unreasonable when we find from reliable data that in two cities of the same size in adjoining States, where about the same social and industrial conditions prevail, the one is paying $97.55 per pupil for secondary instruction and the other $25.47. To be sure we do not know that these outlays represent the same quality

of service to their respective communities, but on careful investigation we should probably find but little difference in quality of instruction, courses of study, percent of population in attendance, educational mortality, etc. There is clearly need of establishing standards.

I shall be able in the brief time allotted me to mention only a few of the investigations and experiments that have recently been undertaken in the secondary field.

During the winter term of this year I spent about ten weeks in high school visitation, which included a hasty inspection of about forty high schools, mostly those belonging to the North Central Association. In, perhaps, one-third of these schools the principal was conducting some form of experimental or statistical investigation. As a rule these investigations were undertaken entirely as a local problem and when completed were of limited value because of lack of standards of comparison.

In three or four schools I found the distribution of teachers' marks under consideration; in two or three, unit costs of instruction; in two or three, an attempt to solve the problem of directed study either by increasing the number of forty-minute periods—to nine in one school—or by lengthening each of six or seven periods to sixty minutes each and dividing the time of each class about evenly between recitation and development and study of new work; in a few cases age-grade tables had been constructed, but very little seemed to have been done to determine causes of failure and withdrawal; in only one school did I find an organized course in vocational information, tho there are two or three other schools in the State doing such work. In one school I found the teachers of the eighth grade using the Hilligas scale in an endeavor to establish standards of achievement in English composition and to improve the quality of the work as measured thereby; in several schools a reorganization is being effected in the seventh and eighth grades, to include these grades in a six-six plan, a six-three-three plan, or a six-five plan, or a seven-four plan, in the latter case omitting the eighth grade entirely.

All of this experimentation is good, but in order to have the greatest value it must be carried on coöperatively under the same conditions and the results be brought together for purposes of comparison. At the present time the High School Principals' Association, thru its research committee, is coöperating with the Department of Secondary Education of Indiana University and the Bureau of Coöperative Research in an investigation of high

school attendance, acceleration, retardation, failure and its causes, repeating, elimination and its causes, promotions, etc. The blank forms for this investigation will be sent out next week to all paid-up members of the Principals' Association and a liberal response is anticipated. Next year, I trust we shall be able to coöperate in the testing of achievement in composition or algebra, and also to have several schools work out unit costs of instruction. I should personally like to see six or eight schools undertake various plans of organization for directed study.

I have here three or four charts summarizing some phases of cost of instruction and relative offerings in different subjects in the high school at South Bend, which I am exhibiting with Superintendent Montgomery's permission. I should add that this investigation was made by Mr. Osborn, a teacher in the South Bend high school, in preparation of his master's thesis, and that since the study is not yet completed, the results as set forth in these charts are to be considered as only tentative. I should also add that these figures are based on average daily enrollment and not on total enrollment, and that this, of course, makes the cost per pupil higher. The complete study will show the results on both bases.

At a time when new courses are being developed and the public is beginning to question both costs and values, we need to make serious studies of this sort. As a result of a similar investigation made by Superintendent F. E. Spaulding, formerly of Newton, Mass., Greek was dropped for the first time from the Newton high school on the ground that the high cost due to the small number of pupils choosing it was not justified. So that, as we consult this chart (Fig. 24, Cost) and note the wide differences in the cost of two credits each in music, English, and manual training, the question arises "Do two credits in each of these represent equivalent values? If so, should we pay such widely divergent sums as $1.90 and $29.50 for equivalent values?"

The second chart (Fig. 25) shows the composite ingredients of the average high school pupil's program of work. This, in conjunction with a vocational survey of the city and a study of the occupations entered by high school graduates, should indicate whether or not the high school offerings are suited to community needs.

In every subject of the many schools I found within any one subject a very great diversity as to quality of instruction, quantity and quality of equipment, and even of cost of apparently the same equipment, and standards of achievement in general.

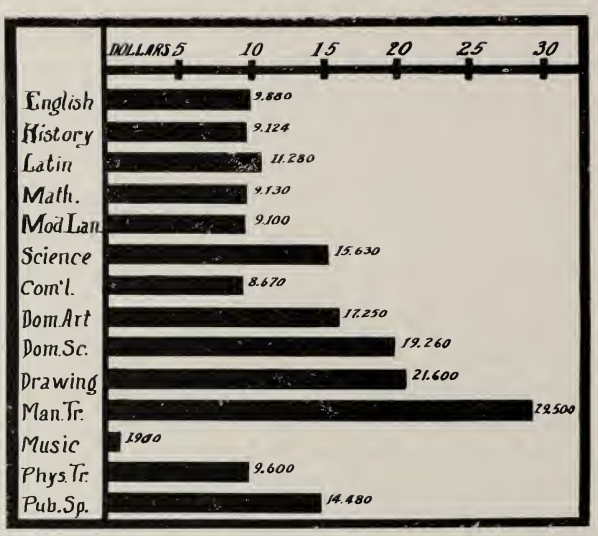

FIG. 24. COST OF ONE YEAR'S WORK, OR OF TWO CREDITS, IN EACH SUBJECT IN THE SOUTH BEND HIGH SCHOOL, FOR THE YEAR 1913-14 (APPROXIMATE)

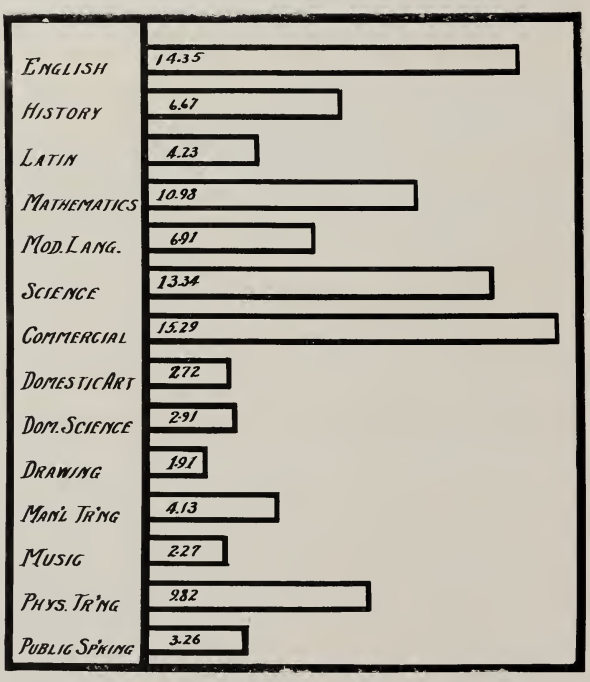

FIG. 25. COMPOSITE INGREDIENTS OF THE EDUCATION OF THE AVERAGE HIGH SCHOOL PUPIL IN THE SOUTH BEND HIGH SCHOOL, EXPRESSED IN PERCENTS

I believe the State Department would do a good work to prepare and send out, to every high school, standards for the following: size of classrooms for from twenty-five to thirty pupils; size of laboratories, manual training, cooking, sewing, and commercial rooms for from twenty to twenty-four pupils; desirable equipment for each subject, laboratory, etc., as to quantity, quality, and cost.

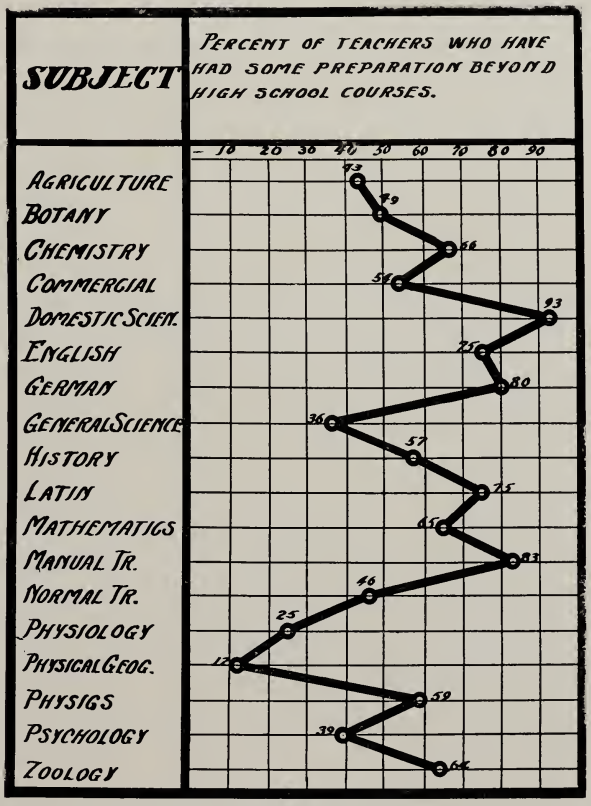

FIG. 26. CAUSES OF INEFFICIENCY: LACK OF PREPARATION OF TEACHERS. (BASED ON DATA FROM KANSAS HIGH SCHOOL SURVEY, 1914)

These charts explain why much of our high school teaching is not more efficient. [Here the speaker referred to charts from the Kansas High School Survey on Tenure of Office and Amount of Preparation.] The data relative to the tenure of teachers indicate that 786 of the 1,580 high school teachers included in the survey were serving their first year in their present positions, and that 392 were serving their second year.

When one-half our teachers change positions every year and three-fourths within two years, it is impossible for them to have taken root in the school and community life so as to have reached a high degree of professional efficiency. Lack of preparation, as shown by this chart (Fig. 26) is, perhaps, a still more potent factor contributing to a low state of efficiency. How vital do you expect physical geography teaching to be where eighty-eight percent of the teachers of this subject have had no courses beyond the meager ones offered in eighth or ninth grades? It is a case of trying to slake the thirst from a dry spring. Fifty-one percent of teachers of botany have had no botany training beyond high school courses, mostly in the ninth grade. But fifty-seven percent of history teachers and sixty-five percent of mathematics teachers have had training beyond high school courses. Do you wonder at the high educational death rate in our high schools?

State legislation requiring at least two years of collegiate training and ultimately a full college preparation for all high school teachers is greatly to be desired. But whatever the degree of teacher training the most vital teaching will be done in those schools in which definite provision is made for growth while in service. This is a problem of real supervision of which there is all too little in the secondary field. Certain superintendents present at this conference have told me that perhaps the greatest benefit accruing from their attempts to measure achievement along certain lines by means of standard tests has been in the keen interest and intelligent insight awakened in the teachers taking part in these experiments, or as one man put the case, "The use of these tests has been my most effective means of supervision."

The three speakers who are to appear next on the program represent different phases of experimentation and service which the University, thru the School of Education and the Extension Division, is trying to carry out in furtherance of the educational interests of the State, particularly in the secondary field.

MR. HINES: We will hear next a paper on "Possibilities in Consultation Work with History Teachers", by O. H. Williams, Assistant Professor and Critic Teacher in History, Indiana University.

THE PROBLEM OF CONSULTATION WORK WITH HISTORY TEACHERS

Mr. Williams: Mr. Chairman, ladies, and gentlemen, I desire to suggest a slight change in the statement of the subject assigned me. I do not wish to appear in the rôle of an advocate or a propagandist. I am not attempting to make a case for consultation work, but rather to define its function and explain its essential nature. In place of the possibilities, I prefer to speak of the problem. My theme, then, shall be, "The Problem of Consultation Work with History Teachers".

1. *What is consultation work?* A phase of educational activity so recent in its inception requires careful delimitation. What is its real nature? What is its place and function in the complex system of organized educational work? What relation does it bear to the general subject before this conference?

Viewed from one side, consultation work is a refined and specialized form of the school survey. It *is* the school survey applied in an intensive way to one of the school subjects. But it is also something more. It seeks not only to evaluate conditions and detect inefficiency or point out excellences, but it also aims to supply vision and stimulus for teachers in the everyday teaching of history. It is therefore an expert form of directed supervision. But it is even more than this. It not merely scrutinizes conditions as they are and attempts to apply remedies where needed, but it probes deeper and searches for fundamental facts and processes in the teaching of history. It is, in a word, a unique species of educational research. Its ultimate end is to reduce the teaching of history to a strictly scientific and fundamentally correct basis. Its laboratory is found in the Critic School, and its final tests and applications are made in all of the schoolrooms in the State.

2. *What is the problem of consultation work?* Its problem is fourfold:

(*a*) To study intensively actual conditions in the organization and teaching of history thruout a system of schools. This it does on the ground by visitation and observation of class instruction, conferring with teachers and supervisors, and surveying the facilities and equipment for work.

(*b*) To help the teachers to discover and utilize their own resources and those which lie close at hand. This it accomplishes

thru personal consultation and group conferences, and by exhibits and demonstration lessons and exercises.

(*c*) To organize and direct the teachers of history in the coöperative study of their problems and in constructive work in their field. This is achieved largely by a selected group of representative teachers, working in coöperation with supervisors and administrative officers, in a common attack upon some such problems as the history course, the supply of material resources, plans for vitalizing history work and adapting it to children in the various grades.

(*d*) To gather, analyze, and disseminate facts bearing upon the social values of the subject, such as are found in the attitudes of teachers and students toward it.

3. *How may history consultation be expected to function in these different ways?*

In the first place, it makes a survey of the history work thruout a system of schools. It starts with facts and conditions as they are. It studies closely (but withal sympathetically) the history instruction thru grades and high school, with special reference to the quality, spirit, and method employed; it views the entire course of study in history, with respect to the plan, organization, materials, and relations with other subjects in the program; it looks into the resources, visible and invisible, which are at the command of the teachers. All these factors consultation service evaluates and judges in the light of educational theory and practice and of desirable social aims and standards of work.

It should be noted that consultation, such as we have here in mind, does not indiscriminately sweep into the scrap-heap the work of teachers, the plans and organization of supervising force, or the equipment supplied by the administration. Rather it is as diligent and enthusiastic in finding and conserving excellences as in condemning and eradicating deficiencies. In fact, it is more vitally concerned with the discovery and conservation of the best work than with the exploitation of what experience and experimentation have demonstrated to be poor work. One case may serve to illustrate. While engaged in consultation service early in the present year, the writer found the opportunity to study some really excellent teaching by a group of teachers in the lower grades of a certain city. The work of adapting history to children's interests, of relating the facts of history to the lives of the pupils, of stimulating and interesting presentation thru visualized and concrete forms, simple dramatization, and constructive exercises, had been

stressed by the supervisors with the help and guidance of the school superintendent. This work was commended, redirected in one or two particulars, and passed on to other groups of teachers in other systems of schools.

Yet to be of real value, a consultation service should apply well-defined standards and rather severely condemn those features in the work which fall below the requirements. The hopeful and encouraging element in the situation is to be found in the cordial and genuine welcome given by school superintendents and supervisors to the careful analysis and close application of the knife. This analysis and evaluation of the conditions is made in part upon the spot, and more comprehensively in the written report to the school authorities.

In the second place, consultation of the right sort will help teachers to discover and put to account their own resources and those which lie unused at ready command.

In the matter of materials, for example, for use in the lower grades, the choicest stories and instructive bits of human experience,—rich in social suggestiveness and extremely well-adapted to younger children,—lie concealed in the local pioneer traditions in which every community abounds. How to bring them to the light of day, how to clothe them in attractive garb, how to use them in an effective way, is a problem beyond the ken of most teachers in the public schools, if they be not directed by expert and experienced hands. For most teachers, the treasure-house of community history remains double-locked. The rich stream of local life lies untapped.

Again, for advanced grades, a vast reservoir of reading and illustrative matter lies ready at hand, but still undiscovered by the rank and file, in the publications of State and federal governments. Maps, pictorial collections, monographs unexcelled in authenticity, illuminating reports, are but a few of the many sorts of resources which may be had almost for the asking.

In the matter of fundamental aims and points of view, the history teacher is often, indeed usually, quite at sea. She is like a mariner without chart or compass. All too rare is the teacher who has acquired the fine art of relating historical instruction to the life and conditions of the present day. One of the fundamental defects in the teaching of history, as observed by the writer over and over again, is the failure to do this very thing. Much, indeed most, of the history course pertains to times and conditions remote from our own. It is simple enough for the teacher to fall

into the easy, academic, textbook fashion of teaching history. But to trace connections between the life and culture of past times and of the present; to establish parallels and make fruitful comparisons; to illuminate contemporary social, political, and economic questions with the light of past conditions, is not so easy or simple. All too few are the teachers of history who are thoroly imbued with the social point of view. Herein lies one great opportunity of the consultation service. By stressing the point of view, by citing numerous and concrete illustrations of vital history teaching thru articulations with present-day conditions, by pointing out failures to make such connections, by demonstration of the stimulating effect upon children's interest when such connections are made, one of the most valuable services may be rendered to teachers of history.

As for standards whereby teachers may judge the quality of their own work, and in some measure test its effectiveness, they are usually even less clear and certain than in relation to the point of view. If standards of value are set up, they are given new resources within themselves whereby to pass judgment upon their own work, to evaluate it properly, and to bring it to higher degrees of efficiency. History consultation finds here another opportunity no less important than the one just mentioned. It should have well-defined teaching standards,—not merely the general quality standards of provision for organization, motivation, initiative, and appraisal of values,—but the more essential history standards of training the historical judgment, interpretative power, and concreteness of detail, as well as the application of historical knowledge.

In the third place, history consultation should seek to organize and direct the teachers in concentrated study and coöperative activity looking to the betterment of the history work thruout their schools. It should, in a word, not only afford teachers a new vision of their work, and place a value thereon, but it should set in operation the forces for redeeming the situation.

This may be brought about by securing coöperative effort on the part of the school administration, the supervisory staff, and the teaching faculty. Whatever work of reconstruction is undertaken, the teachers should themselves have a large and important share in accomplishing it. A representative group of teachers should be selected, including those who have had special training in history and those who have a natural regard for the subject. This group may subdivide their work, one portion to plan or

reconstruct the course of study, another to consider the material needs and the best mode of relating the subject to the community interests.

Such a committee of teachers (and principals) is not only likely to develop a superior plan of work, but in the process of doing so to catch the spirit of the course, a spirit readily communicable to the entire teaching body.

Finally, consultation service has the highly important function of collecting, analyzing, and giving out for the common good facts bearing upon the real and assumed values of the subject. Of all forms of directive supervision, this needs most to be anchored to solid earth. Whatever in theory or practice is accepted as good must find approval in the common experience of teachers and supervisors, of pupils in the schools, of students of education, and of persons in all of the walks of life. The test of experience, we believe, must be the final criterion for judgment of values in history as in other school subjects.

It is the function of this work to consult in the most economical and scientific way the largest possible group of persons concerned. As an instance of what may be accomplished in this way, let us note the results of two letters of inquiry recently sent, one to the teachers of history and principals of the commissioned high schools of the State, the other to recent graduates of these high schools, viz., to college freshmen.

Now, the really important subject which is engaging the attention of high school teachers of history is that of needed readjustments in the course of study. Many excellent teachers have long felt that the prevailing program in history and civics for high schools is ill-balanced and ill-adapted to twentieth-century social and industrial needs. The arrangement, for example, whereby one-third of the time in a three-years' program is given to ancient history is a poor distribution of work. The ancient world, they say, has important bearings upon the modern, but its essential features may well be treated in a half year. Much of the subject material taught in the full year of ancient history, so far as social value is concerned, is the veriest rubbish. Its mastication and digestion by red-blooded boys and girls is effort worse than wasted. Yet twice as much time is devoted to ancient history as to modern Europe, or to either American history or to civics. As a result, our youth are leaving the high schools without real understanding or appreciation of the factors which have made the Europe of today, or of the social and economic problems which

face the American people. So much for the belief of these teachers in the fore-front. What is the consensus of opinion which is born of experience of students and teachers thruout the State? Let us first view the analysis of the replies from the principals and teachers. The nature of the questions submitted is sufficiently indicated in the detailed replies which follow:

I. REPLIES FROM HIGH SCHOOL PRINCIPALS AND TEACHERS OF HISTORY

A. From all schools.	Number		% of Total	
1. Total schools addressed	441	...	100.0	....
Total schools responding	...	212	....	48.0
Total schools not responding	...	229	....	52.0
2. Total responses received	290	...	100.0	....
Total from teachers	...	120	....	41.3
Total from principals	...	161	....	55.5
Total from superintendents	...	9	....	3.2
3. Facts indicated by replies.	Number			
a. Courses of study.	Schools		% of Total	
*Standard three years	183	...	86.3	....
None required	...	6	....	2.8
One year required	...	68	....	31.6
Two years required	...	30	....	14.1
Three years required	...	71	....	33.4
Not stated	...	8	....	3.7
*Standard four years	9	...	4.2	....
None required	...	2	....	0.9
One year required	...	5	....	2.3
Two years required	...	2	....	....
*Non-standard courses	20	...	9.5	....
Two years' course	...	7	....	3.3
Three years' course	...	9	....	4.2
Four years' course	...	4	....	1.9
Total on courses of study	212	212	100.00	...
b. Satisfied with course.	Number		% of Total	
Yes	...	220	....	75.8
No	...	67	....	23.1
Not stated	...	3	....	1.1
Total	...	290	....	100.0

*Standard courses are the three or four "blocks" recommended by the Committee of Seven, viz., ancient, medieval and modern, and American and civics (3 years), or ancient, medieval and modern, English, and American and civics (4 years). Non-standard courses are all other combinations.

c. Value of fields offered. (Total replies, 290.)

Field	Least Value	Most Value	% L. V.	% M. V.
Ancient	149	13	51.3	4.4
Medieval	47	3	16.2	1.0
Industrial	7	1	2.4	.3
American	6	76	2.0	26.2
American and Civics.	0	92	.0	31.7
Civics	4	22	1.3	7.5
Modern	1	26	.3	8.9
Medieval and modern.	5	8	1.6	2.7
Not stated	71	55	24.4	18.9

d. Preference of fields. (Total replies, 290.)

Fields	Number	% of Total
Ancient	80	27.5
Modern	209	72.0
Not stated	1	0.5
Industrial history	74	25.5
Economic emphasized	172	59.3
Not stated	44	15.2
Civics separate	121	41.7
Civics correlated	163	56.2
Not stated	6	2.1
English	131	45.1
European	93	32.0
Not stated	66	22.9

e. Should a syllabus be prepared?

Yes	196	67.5
No	43	14.8
Noncommittal	51	17.7

B. From larger schools. (In cities and towns of more than 2,000 population.)

1. Total replies received..... 136
2. Total schools responding..... 84
3. Facts indicated by replies.

	Number		% of Total	
a. Enrollment of pupils.	(First Sem. 1914-15)			
Total in 84 schools	24,126		100.0	....
Total in history classes	11,842		49.0	....
Total in ancient history	4,315		....	36.4
Total in medieval and modern	2,597		....	21 9
Total in American and civics.	2,894		....	24.4
Total in English history	364		....	3.0
Total in industrial history	726	(est.)	....	6.1
Total in civics alone	332		....	2.8
Total in economics	65		....	0.5
Total in general history	49		....	0.4

b. Courses of study.	Number Schools	% of Total
Standard three years	65	77.3
None required	2	2.3
One year required	31	36.9
Two years required	10	11.9
Three years required	22	26.1
Standard four years	7	7.0
None required	1	1.1
One year required	3	3.5
Two years required	3	3.5
Non-standard courses	12	15.7
Two years' course	1	1.1
Three years' course	7	7.0
Four years' course	4	4.6

c. Satisfied with course. (136 replies.)

	Number	% of Total
Yes	98	72.0
No	35	25.7
Noncommittal	3	0.3

d. Value of fields offered.

Field	Least Value	Most Value	% L. V.	% M. V.
Ancient	69	13	50.7	9.5
Medieval	20	1	14.7	0.7
Industrial	9	1	6.6	0.7
Medieval and modern	12	8	8.8	5.8
Modern	4	18	2.9	13.2
American	5	37	3.6	27.1
American and civics	0	45	0.0	33.0
Civics	2	14	1.4	10.2
English	2	4	1.4	2.8
Noncommittal	23	16	16.9	11.6

e. Preference of fields. (Total replies, 136.)

Fields	Number	% of Total
Ancient	35	25.7
Modern	92	67.6
Noncommittal	9	6.7
Industrial history	28	20.5
Economics emphasized	70	51.4
Noncommittal	48	28.1
Civics separate	59	43.4
Civics correlated	64	47.0
Noncommittal	13	9.6
English history	60	44.1
European	58	42.6
Noncommittal	18	13.3

f. SOME TYPE COURSES SUGGESTED IN REPLIES

9th Year	*10th Year*	*11th Year*	*12th Year*	*Number*
Anc. 2	Med.-Mod. (to 1700)	Mod. 2 (1700 to date)	Am. 1-Civ. 1	1
Anc. 2	Med. 1-Eng. 1	Mod. (inc. Am.)	Civ. 1-Ec. 1	1
Anc. 2	Med. 1-Mod. 1	Eng. 1-Am. 1	Civ. 1-Ec. 1	2
Ind. 2	Med.-Mod. 2	En. 2	Am.-Civ. 2	2
Anc.-Med. 2	Mod. 1-Eng. 1	Am. 2	Civ. 1-El. Ec.	1
	Anc. 1-Med. 1	Eng. 1-Civ. 1	Am. 2	1
	Anc. 1-Med. 1	Mod. 1-Am. 1	Am. 1-Civ. 1	2
	Anc. 1-Med. 1	Mod. 1-Eng. 1	Am. 1-Civ. 1 or Ec. 1	13

We shall next examine the results obtained from the letter of inquiry addressed to college freshmen. These results are partial in their nature, being confined to the replies received from the freshmen at Indiana University and Franklin College, and to the one point of attitude toward the various fields of history.

II. REPLIES FROM COLLEGE FRESHMEN

1. Total replies examined 246
2. Facts indicated by replies.

a. Value and interest of fields. (Total replies, 246.)

Fields	Most Value	Least Value	% M. V.	% L.V.
American	131	18	53.2	7.3
Civics	51	9	20.7	3.6
English	17	8	6.9	3.2
Medieval and modern	12	12	4.8	4.8
Modern	14	14	5.6	5.6
Medieval	11	57	4.4	23.1
Ancient	43	114	17.4	46.3
Not stated	8	23	3.2	9.3

b. Attitude on leaving high school. (Total replies, 246.)
Total desiring to:

	Number	% of Total
Pursue the study	133	54.0
Leave off study	113	45.9
Positively avoid	63	25.6
Neutral	50	20.3

MR. HINES: The next speaker will be Mr. C. E. Montgomery, Critic Teacher in Botany, in Indiana University. His contribution is entitled "The Botany Situation in Indiana High Schools".

THE BOTANY SITUATION IN INDIANA HIGH SCHOOLS

MR. MONTGOMERY: Many teachers, both in colleges and high schools of Indiana, have long felt that the teaching of biology is not accomplishing the results hoped for. Various reasons have been given for this failure, but until the present there has been no body of facts upon which anyone could base statements regarding science criticisms.

In February, 1914, one hundred and fifty sets of a questionnaire were sent to as many commissioned high schools of the State. Only the best high schools were included because it was considered perfectly safe in assuming that conditions in the lower grades of schools were at least no better. Of those sent out sixty-eight were returned more or less carefully answered. In making the questionnaire only two factors in the work were thought to need investigation, the teacher and the course of study. The child indeed should not be left out, but in this case he was looked upon as a constant, and therefore not subject to a large number of variations.

The demand that teachers employed in the better high schools be college graduates is being fairly well met. Of the sixty-eight reporting, nine teachers hold master's degrees, thirty-six bachelor's degrees, and seventeen are normal graduates. Six did not report. However, the mere fact that a teacher is a college graduate, or nearly so, does not mean that he or she will be a successful instructor in all lines of work. The teacher with the college diploma and one year or less of botany to his credit is not necessarily any better, if as good, a teacher of botany as an undergraduate equipped with a much wider knowledge of the subject.

The following figures show to some extent the preparation in subject-matter of those teachers handling botany in these schools: Twelve are "majors" in botany, five in zoölogy, four in mathematics, four in history and economics, five in English, eight in physics, seven in chemistry, four in German or Latin, two in philosophy, two in education, six in agriculture, horticulture, and other practical sciences, and nine did not report. These figures show that about eighty percent of the teachers handling botany in our better high schools are primarily interested in some other kind of work. This condition is emphasized more fully by the following data: Eight teachers report less than one year of botany work, fifteen from one to two years, three from two to three years, and fourteen from three to four years. Twenty-six others give gen-

eral science and biology for their scientific training. It is quite generally conceded that to handle high school botany in anything like an efficient manner, one must have at least two years of college work in this line. As facts show, just about twenty-five percent of the teachers of this work in our largest and best equipped high schools can meet such qualification.

If the lack of preparation in subject-matter were the only shortcoming of botany teachers, the status of teaching would not be so grave. If these teachers understood the organization and method of the subject, the besetting difficulties would be more easily alleviated. Forty-nine of these teachers have had no work in education, and nineteen report from twelve to twenty-four weeks' work in learning how to teach botany. Even for those who have a sufficient grasp upon the subject-matter, the organization and manipulation of botany work in the high school often prove a serious stumbling-block. Many teachers fail to get the best results simply because they do not understand how to operate the machinery to the best advantage. Adding to the above deficiencies, the complaints of too much work, too short time, etc., it is seen that there is much room for improvement in respect to the teacher's own equipment.

In these sixty-eight Indiana high schools, botany seems to stand out strongly as a freshman science. Forty-eight schools give it in the first year, eight in the second, two in the third, and two in the fourth. Forty require botany for graduation and seventeen make it elective. From these facts one of two things seems evident: either school authorities consider botany very much worth while, or it is the cheapest and most easily handled science for high schools. It is sincerely hoped that the former is the impelling motive. Various teachers gave the following estimates as to the value of high school biology: Twenty say it prepares for other sciences, nine say it trains observation, eight think it brings the child closer to nature, fifteen feel that it is very important, nine say it is educative, six get appreciation from it, five say it gives valuable knowledge, one thinks it can help solve the sex problem, and three say it is of no value as taught at the present time. Some of these answers are to the point, but the others simply show that teachers have no good notion of what botany may do for the child. Before the botany work of our high schools can approach any nearer fair results, it is essential that instructors understand definitely and clearly the mission of biology in education as separate and distinct from that of other subjects.

One of the most difficult problems that teachers confront when undertaking botany work is the selection and organization of the materials for class work. There are several types of botany courses outlined in botanical literature, but with all these, seldom does the teacher find one to his liking. Of the sixty-eight persons reporting to this questionnaire, forty-five sent brief outlines of the work done in their classes. From the list of topics given one can see that almost every phase of botany is touched upon in high school work. Thirty-three schools study the structure and functions of the organs of seed plants; thirty-one give the evolution series; sixteen classification; fifteen forestry and tree classes; nine ecology; seven agricultural materials; seven pollination; five soils; four weeds; three horticulture; three reproduction; two plant industries; and one each for the food groups, botanical chemistry, theory of evolution, survival of the fittest, and mitosis. This is a wide field to be covering in one year's work, yet with the exception of the last three or four topics, all have a legitimate claim to a place on the program. Two things stand out pre-eminently above the rest: the structure and function of seed plant organs and the evolution series. If these were the only topics, it is at once evident that the work cannot be handled with slight preparation.

The majority of schools claim to be giving their courses a practical emphasis, but in many cases "practical botany" means nothing more than a mere study of the textbook. This attempt at teaching utility botany without knowing what it means is doing very much to break up the organization and destroy the results that should be obtained from a study of botany.

Studying these outlines of courses in the State one is forcibly struck by the variation in them. No two schools seem to be doing the same things at the same time. The work on flowers is given in fall, winter, and spring. Other topics are as widely dispersed thru the year's work in different localities. This wide variation bears witness to the fact that there is no correlation of the botany work in this State. No doubt local conditions should govern to some extent the order of topics, but it is hardly probable that they should require that ecology, pollination, and flower structures should be given in midwinter when eleven inches of snow cover the ground. This lack of correlation among high schools, and with the other sciences in the same schools, is one of the weakest points in the botany work.

So far as the subject-matter is concerned no harm can be done by jumbling up the work, but so far as the living interest in the

subject and the welfare of the child are concerned, this disorganization should not be permitted. The arrangement of topics in a high school course is a much mooted question, and can be settled only by a thoro understanding of the true aims of the work. A close familiarity with Lloyd and Bigelow's last edition of "Biology in Secondary Schools" will aid materially in the work.

While botany in Indiana high schools is not satisfactory, it would not be fair to say it is an absolute failure. Much good is being done in many quarters in spite of the defects. All the blame for inefficient work should not fall upon the heads of the teachers nor should the burden of supplying remedies be left altogether to them. The work needs careful supervision. Botany courses without good laboratories and efficient administration should not exist, nor should teachers be allowed to hold the work out as a sort of bait for popularity. School officials should demand teachers well prepared for the work, both in subject-matter and in the teaching thereof. They should require that the courses be organized according to the best modern ideas, and that there be correlation with work in other schools and with the other sciences. This does not mean to follow a hard-shelled course, but a carefully worked out standard. Why should there not be standards for science work as well as for Latin, mathematics, and so forth? If administrative officials should adhere closely to these requirements, the discrepancies in science teaching would soon disappear. These requirements would soon bring about the same results as those that raised the standard of high school teachers from mere license-holders to college graduates, and the efficiency of science work would soon be greatly increased.

Mr. Hines: The next address on the program is entitled "Standards and Measurements in English Composition", by Mr. Earl Hudelson, Critic Teacher in English, Indiana University.

STANDARDS AND MEASUREMENTS IN ENGLISH COMPOSITION

Mr. Hudelson: Mr. Chairman, ladies, and gentlemen, I shall give a brief report of a test made in the local schools in the seventh, eighth, and ninth grades, based upon the Harvard-Newton scales test in composition, and the conclusions arrived at by Miss Kerr, Principal of the Department building, and myself. This test was based merely upon description, following the Harvard-Newton scale. The test was made with 386 pupils. There were

twenty graders, eight of them being high school teachers, four seventh- and eighth-grade teachers, and eight students of the University.

The test was made on February 23d of this year, and because it may seem a little unfair to high school pupils, please remember that this test was made immediately after the middle of the year, at the beginning of the second semester, when the pupils that are called 7A's were really 7B pupils. This work was done immediately after they had finished their 7B semester; so that the test covers two and one-half years in the grades, and a half-year in the high school. Unfortunately we have too few semesters in the high school to make the test as fair to the high school pupils as to those in the grades.

We found that this Harvard-Newton scale suggested subjects that were not suitable to this locality, so we substituted topics, or subjects, as nearly their equivalent as possible. The seven subjects for description which we offered were: (1) Some Person in Bloomington; (2) Grandmother; (3) An Old Fashioned House; (4) A Picture; (5) A Public Building in Bloomington; (6) A Body of Water; (7) A Wreck.

Thirty minutes were given for actual composition of the first draft, ten minutes for preliminary explanation, and thirty minutes for writing. Later the pupils were allowed to correct and rewrite for thirty minutes more. These papers were collected and numbered. There was no means of identification on any of the pages except the first, which was a key sheet indicating the writer of each composition and his number, and which was kept in the office. After the papers were jumbled, they were divided into eight groups of approximately fifty each, and each group was then rated by three graders. These results were kept separately; the average was also taken; and later, as I shall explain, they were graded again. The above results were put in both tabular and pictorial form.

TABLE VI.—ACHIEVEMENT IN COMPOSITION (DESCRIPTION) BY GRADE AND SEX OF 386 PUPILS IN GRADES 7, 8, AND 9 IN THE BLOOMINGTON SCHOOLS, AS MEASURED BY THE HARVARD–NEWTON SCALE (APRIL, 1915)

The figures represent the average obtained from the ratings of three different judges.

Grade...	7B			7A			8B			8A			9B			9A			Total		
SCORE	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
44	6	.....	6	2	.....	2	1	.....	1	1	1	2	.....	.....	.....	.....	.....	.....	10	1	11
45	.....	1	1	.....	1	1	.....	.....	.....	.....	.....	.....	1	.....	1	.....	.....	.....	1	2	3
46	1	.....	1	.....	.....	.....	2	.....	2	.....	.....	.....	1	.....	1	.....	.....	.....	4	0	4
47	.....	2	2	.....	1	1	.....	1	1	2	.....	2	.....	.....	.....	1	.....	1	3	4	7
48	1	.....	1	1	1	2	1	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	1	4
49	.....	.....	.....	.....	.....	.....	1	.....	1	.....	.....	.....	.....	1	1	.....	.....	.....	1	1	2
50	2	2	4	3	.....	3	.....	.....	.....	.....	.....	.....	.....	1	1	.....	.....	.....	5	3	8
51	2	2	4	.....	1	1	2	.....	2	.....	.....	.....	3	.....	3	.....	.....	.....	7	3	10
52	1	1	2	1	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1	3	1	4
53	.....	.....	.....	1	2	3	1	.....	1	1	.....	1	1	.....	1	2	.....	2	6	2	8
54	.....	1	1	1	1	2	3	.....	3	.....	.....	.....	.....	.....	.....	1	1	2	5	3	8
55	1	1	2	.....	2	2	.....	.....	.....	2	.....	2	.....	.....	.....	1	1	2	4	4	8
56	.....	1	1	1	1	2	3	1	4	.....	1	1	.....	.....	.....	.....	.....	.....	4	4	8
57	1	1	2	1	.....	1	.....	1	1	1	.....	1	.....	.....	.....	.....	.....	.....	3	2	5
58	1	4	5	1	2	3	1	2	3	1	1	2	1	1	2	1	.....	1	6	10	16
59	2	2	4	1	3	4	.....	1	1	2	1	.....	1	3	3	1	.....	1	6	9	15

TABLE VI.—Continued.

Grade...	7B			7A			8B			8A			9B			9A			Total		
SCORE	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Cirls	Total
60	1	1	2				2	3	5	1	2	3	2	1	3	1		1	7	7	14
61	2	2	4	1	2	3	1		1				1		1	1		1	6	4	10
62				3		3					1	1				3		3	6	1	7
63	2	2	4		2	2	2	1	3	1		1	1		1	1		1	7	5	12
64	1		1	1	5	6		2	2	1	1	2	3	2	5	2	1	3	8	11	19
65					4	4	1	1	2		2	2		1	1	2		2	3	8	11
66	2		2		1	1		1	1	4		4	2	1	3	3	4	7	11	7	18
67		1	1		3	3	1	4	5		2	2		1	1	1	2	3	2	13	15
68	2	1	3	1	2	3		3	3	1	3	4	2	1	3	3	3	6	9	13	22
69	1	1	2		2	2		2	2		2	2	1		1		1	1	2	8	10
70	1	2	3	1		1		1	1	2	3	5	2	1	3	2	3	5	8	10	18
71		1	1		1	1	1	2	3	1	1	2	1	1	2	1		1	4	6	10
72	1	3	4		2	2					2	2		1	1	1	1	2	2	9	11
73	1		1					3	3					4	4				1	7	8
74	1		1	1		1		2	2							2		2	4	2	6
75										1	5	6					2	2	1	7	8
76	1		1		3	3		4	4		1	1		3	3	2	2	4	3	13	16

77				1		1	1	1	2	1		1							3	1	4
78					1	1				3	1	4		3	3	1	2	3	4	7	11
79		1	1					3	3								1	1		5	5
80					2	2							1		1				1	2	3
81					2	2							1	2	3				1	4	5
82								1	1		2	2		2	2					5	5
83								1	1				1	1	2				1	2	3
84											1	1					1	1		2	2
85					1	1					1	1		1	1	1		1	1	3	4
86					1	1		1	1		1	1					1	1		4	4
87				1		1													1		1
88								1	1		1	1								2	2
89											1	1								1	1
Total..	34	33	67	23	49	72	25	43	68	25	36	61	25	32	57	35	26	61	167	219	386
M.....	59.5	59.5	59.5	59.	65.2	64.	56.6	69.5	65.5	66.2	70.6	69.	64.6	73.	68.3	66.	70.	68.	62.	68.3	65.9
M. D....	9.7	9.3	9.3	7.5	7.5	8.0	6.1	7.5	8.7	8.5	6.2	7.4	6.8	8.5	9.0	6.	5.2	6.5	7.5	8.4	7.9
V.....	16.%	15.6%	15.6%	13.%	11.5%	12.5%	10.8%	10.8%	13.%	13.%	8.8%	10.7%	10.5%	11.6%	13.%	9.%	7.4%	9.6%	12.%	12.3%	12.%

Table VI is a tabular view of the achievement in composition by grades. Here you will find what is to be expected. The numbers are grouped largely in the middle. You will find in the boys' columns the larger figures. Those at the top are larger for the boys than for the girls. Ten boys and one girl received 44 percent, or below. At the top the boys outnumber the girls. At the bottom, (the highest percent being 89), the girls predominate. The largest number of cases falls near the middle—about 65 percent.

The majority of both sexes in 7B were nearly together; but the best girls outdid the best boys by almost 20 percent. The 7B results were neither satisfactory nor typical of total results.

In 7A the boys were about as closely grouped as the girls, the latter, however, being bunched farther up the scale. There was practically the same gradation at either end of the scale, but the grouping was more typical of the entire results of the test.

An equal but slight improvement was made by both sexes in 8A, the comparative rank and the gradation effect remaining about the same. In 9B, however, while the grouping of the girls was not so high in any one place, the general results were more favorable. The boys made a marked rise, their average mounting to between 45 and 60 percent.

The 9A boys made a slight and typical improvement. The girls' grouping was comparatively higher and was characteristic of final results, because it was highest about the composite total median.

The total distribution by sex shows the same general results. One is a little higher than the other, with much in common; but the girls have the advantage. The total results, while indicating nothing but total results, show the usual scale and gradation of the scale, which will be seen, in a moment, in the median group, to be between 65 and 70 percent. I do not know whether the girls do better than the boys because of the greater number of women teachers in the schools or not. I do not know the cause, but I intend to take the results back to the teachers and try to diagnose with them at least some of the causes of these conditions.

Fig. 27 is a pictorial view of the achievement by sexes and grades, and you will see here, in briefer form, starting from the same point, how the girls outstrip the boys in accomplishment. The lower line represents the boys and the upper line the girls. Starting at 59.5 percent, the curve for the boys descends thru grades 7A and 8B, to 56.5 percent, while that for the girls ascends steadily to 73 percent in the 9B grade. The course of progress for

the boys shows a sharp rise in the 8B grade. The second year of high school gives results that are entirely promising, I think, because it seems that here the pupils get on their feet again. Mr. Lewis's charts at the end of the room show how in the Muncie schools whenever the pupils changed schools or buildings they were more or less carried off their feet, and that there was either a decided slump or no rise in achievement, because of the changed conditions. The girls seem to have suffered more by these changes

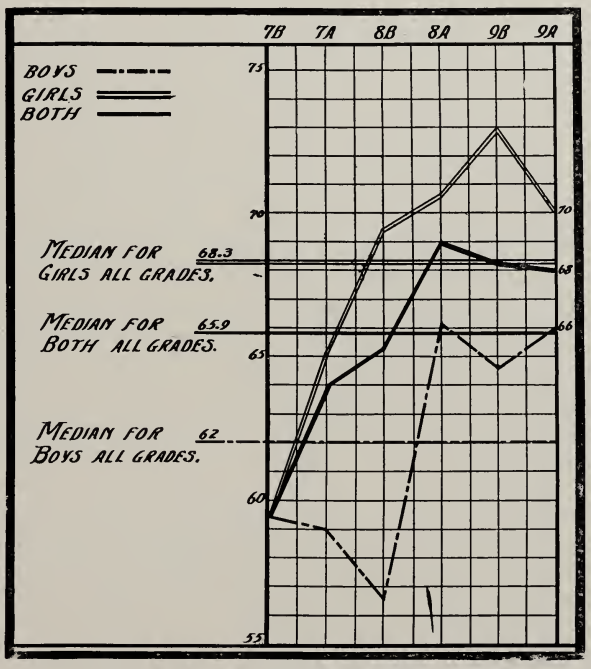

Fig. 27. Graphs Based on Table VI.

into the high school than the boys. Whether the former recovered from this in the second year of high school and immediately went on above the boys we do not know; but the indications are that the boys and girls are becoming more nearly equal in ability. The median line for the boys, in all grades, is 62 percent, and for the girls, 68.3 percent, showing the usual conditions, I believe, for the girls. The total median for the boys and girls together is about 65 percent.

In choice of subject, by sex and by totals, there was found to be a pretty consistent grouping on certain topics, with wide diver-

gence on others. Almost an equal number of each sex chose "Some Person in Bloomington" to describe. The girls were decidedly partial to "Grandmother". "An Old Fashioned House" and "A Public Building in Bloomington" were also popular subjects. The few of either sex that selected a picture did well. The girls shunned "A Body of Water", and found "A Wreck" uninteresting. Several of the boys recognized in these topics better opportunities for description. In choice of subject the boys and girls approached each other more nearly in the last grade.

In comparing the ratings of the 386 themes with and without the Harvard-Newton scale it was found that the highest and lowest rated compositions were identical in nearly every case. Almost the only diversities of opinion in the rankings of the grades—and even these were usually slight—were in the mediocre papers. The range of variation in grade with the scale was about 1.5 percent less than the range without the scale. This would indicate that such a scale as that used in the Harvard-Newton test will slightly steady the pupil's composition average by reducing the teacher's susceptibility to changing moods. No scale, however, will suit all localities, because no set of topics will furnish the proper motive for pupils of all districts. Each region, or even each school system, should work out its own scale in all the discourses, if it would profit most highly from the results that were first indicated by the Harvard-Newton test.

The next paper on the program was to have been given by Mr. Frank G. Pickell, Principal of the Richmond high school, but he was unable to arrive in time to read his paper. However, his paper was subsequently received, and is included in the proceedings.

DISTRIBUTION OF TEACHERS' MARKS

MR. PICKELL: A study of this problem reveals a wide variation in the distribution of teachers' marks. It reveals the lack of uniformity in rating pupils among teachers of the whole school: and likewise among teachers in any given department.

It is not probable that the classes assigned to any teacher are very much superior to the classes of any other teacher. In the organization of a school of three hundred or more pupils this would be the exception. The variation is not likely to be largely dependent upon the subject-matter, altho the prescription of studies in the majority of cases means a higher percent of failures than in

elective studies. The problem of the standardization of the content of the courses enters into the percent of failures and perhaps in a degree into the problem of distribution of marks. However, facts show that teachers, in the absence of more or less carefully defined standards for judging merit, or ability, or progress, are unable to judge accurately the worth of the pupils' work, and this accounts in a large measure for the lack of uniformity.

Many experiments have been made showing the wide variation in the marks given, say, the same English composition, or the same arithmetic paper by different teachers, and indeed by the same teacher at intervals far enough apart to make the experiment a test.

In my faculty the teachers felt the need of greater uniformity in marking pupils, and a survey of actual conditions was made. Twenty-nine members marked the same algebra paper, the same two English compositions, and the same arithmetic paper. The experiment as made was not sufficiently scientific to warrant drawing conclusions too hastily, but it showed certain tendencies in marking pupils and probably certain facts. Following is a summary:

Variation in Marks (29 Teachers)

Algebra .....lowest 52.....highest 80.....mean variation 7.1%
Composition (No. 1).lowest 46.....highest 85.....mean variation 8.1%
Composition (No. 2).lowest 58.....highest 96.....mean variation 7 %
Arithmetic .....lowest 48.....highest 88.....mean variation 6.2%
Average variation 7.1%

Variation in Marks Given by Mathematics Teachers

Algebra .....lowest 65.....highest 78.....mean variation 5.5 %
Arithmetic .....lowest 48.....highest 77.....mean variation 9.75%
Average variation 7.6 %

Variation in Marks Given by English Teachers

Composition (No. 1).lowest 70.....highest 80.....mean variation 3.7%
Composition (No. 2).lowest 60.....highest 90.....mean variation 10.8%
Average variation 7.2%

In making the survey of the distribution of marks for the last half-year we found that the variation indicated by the above experiment did transfer. One teacher gave no marks between 95 and 100, while a second had 21 percent of all marks within this percent group. In the same department we found the marks for this percent group (95-100) varying from 4 percent to 19 percent. In the percent group 85-89 one teacher had marked 12 percent

of his pupils; a second 79 percent; a variation of 65 percent. These are the extremes, but a study of the facts revealed a lack of uniformity everywhere.

From these facts we drew three conclusions: First, a four- or five-division scale for marking pupils would be more accurate than the present percent system, or present letter systems in which the letters represent a latitude of only two or three percent. In this scale the letters should represent a latitude of about seven

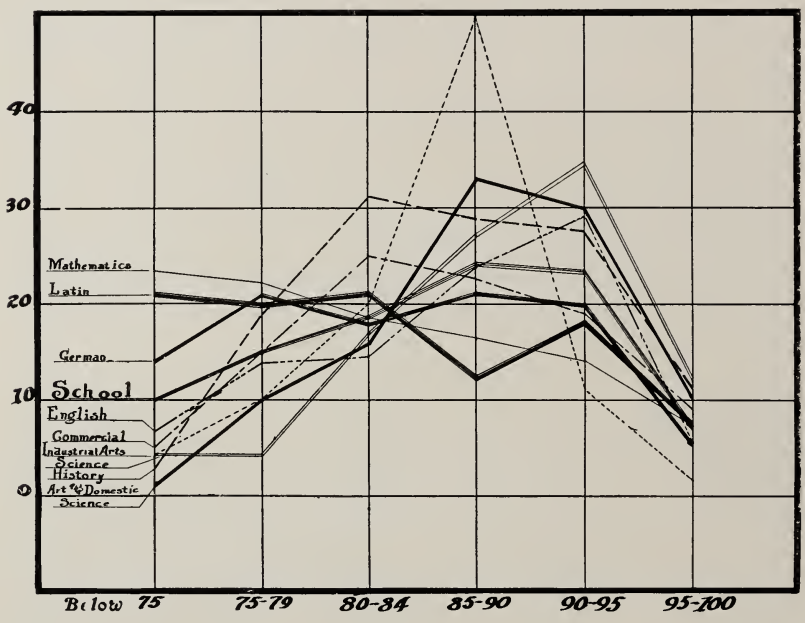

FIG. 28. PERCENT OF FAILING AND PASSING GRADES BY SUBJECTS OF PUPILS IN THE RICHMOND (IND.) HIGH SCHOOL, 1914-15, FIRST SEMESTER

percent, and no attempt should be made to determine whether the student belonged at the top or at the bottom of his division.

Second, in the absence of scales for measuring ability or progress, it would possibly be wise to adopt some scheme for controlling the distribution of marks. When we recall that progress thru school, entrance upon college work, the awarding of scholarship, the winning of prizes,—in fact, the fabric of the school system,—depend very largely upon teachers' marks, the importance of aiding the teacher in accuracy and good judgment is clearly seen That teachers do vary in their marks is in no wise a criticism upon

them. It is rather the indication of the fact that the system has little to offer the teacher as an aid, and further that human traits are hard to measure accurately.

Third, we should do all we can to help in the great educational movement of developing scales and standards for judging school progress. It will, no doubt, be a very difficult task to de-

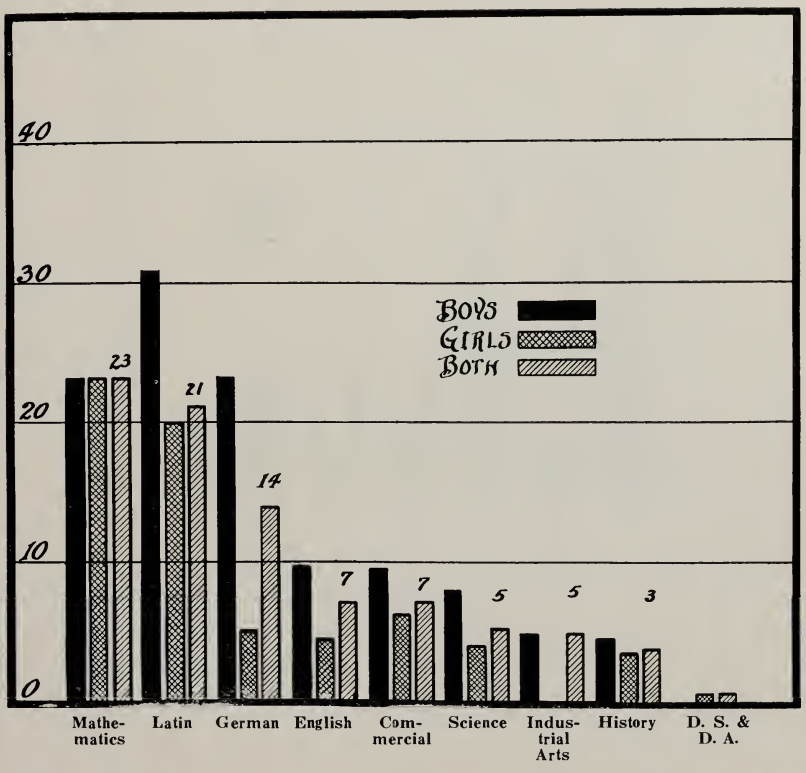

FIG. 29. PERCENT OF FAILURES BY SUBJECTS OF PUPILS IN THE RICHMOND (IND.) HIGH SCHOOL, 1914-15, FIRST SEMESTER

velop a scale for measuring geometry ability, or history ability, but it can be done. Remember how few believed that scales could be devised for measuring handwriting and spelling. And experience in using these scales has shown that we can become much more accurate in our judgment than without their use.

Many other problems arise for consideration in connection with a study of teachers' marks, such as elimination, retardation, the prescription of studies, failures, and allied problems. All these

are serious enough to warrant full treatment. We can take up but one briefly,—the problem of failures.

The percent of failures by departments for the past year in the Richmond high school varied from 0 percent in cooking and sewing to 23 percent in mathematics.

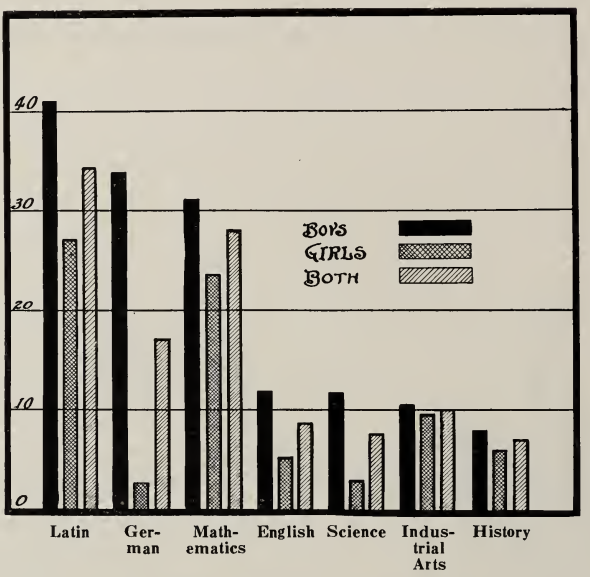

FIG. 30. PERCENT OF FAILURES IN FIRST YEAR SUBJECTS OF PUPILS IN THE RICHMOND (IND.) HIGH SCHOOL, 1914-15, FIRST SEMESTER

The following table shows the failures by departments for Sept., 1914, to Feb., 1915:

Mathematics	24%
Latin	18%
German	15%
Commercial	8%
English	7%
Science	6%
Industrial Arts	5%
History	3%
Domestic Science and Domestic Art	0%

Why should 25 percent of the pupils fail in mathematics and only 6 percent in science? Or 18 percent in Latin and only 3 percent in history? Is this difference due to subject-matter, methods of teaching, to the fact that more of mathematics and

Latin are prescribed than science and history, or to all of these things?

Why is it that in every department in school in first-year studies a larger percentage of boys failed than girls? And why is it that the percentage of failures for both boys and girls in first-year studies is higher than for boys and girls in second-, third-, and fourth-year studies? These and many other questions arise for definite answers. School men cannot longer ignore them. Conditions must be studied, facts searched out, and the remedy for existing defects applied.

Mr. Hines: Mr. Ayres will conduct a round table at this time on "The Measurement of Educational Processes and Products". I have the pleasure of presenting Mr. Ayres.

THE MEASUREMENT OF EDUCATIONAL PROCESSES AND PRODUCTS

Mr. Ayres: The educational instrument most typically characteristic of the new movement for scientific methods in education is the educational scale. These pedagogical scales are essentially different from other forms of tests and examinations. They are like physical scales in that they consist of a series of steps equally distant from each other and having a known relationship to a zero point. Our common scale for measuring short distances is the foot rule. This consists of a series of twelve steps, each one inch long, and all having a common relationship to the beginning or zero point, which represents just no distance at all. Similarly our scale for measuring small weights consists essentially of a determination of total weight in terms of one pound, two pounds, three pounds, and so on. These and all the other similar cases consist of series of steps equally distant from each other and having a common relationship to a zero point. Recently we have begun to develop such scales in the field of education. But when we measure our educational product by such a scale the result is very different from measuring it by the ordinary percentage method customarily used in the classroom.

When the child in the composition class receives a mark of eighty percent this does not mean that the product is twice as good as that of another child whose mark was forty percent, or that it was four-thirds as good as that of the child whose paper was marked sixty percent. In other words, school marks do not follow the ordinary rules of common arithmetic. This is pre-

cisely what the markings obtained by the new pedagogical scales do accomplish, and this is one of the reasons why the development of these scales marks so important an advance in the science of education.

In order to secure this characteristic of having the successive steps on the scale indicate progressive values increasing by equal amounts, all of the new scales are fundamentally based on the theory of the so-called normal distribution of intellectual abilities. For this reason we should understand something of the nature of the normal distribution surface if we are to consider intelligently the nature of the new educational scales.

If you should go out under a tree and pick up 10,000 leaves and place these leaves in a long row according to size so that the smallest leaf was at the left end of the line and the biggest one at the right end you would find that you had a very few very tiny leaves, a great number of medium-sized leaves, and a very few very large leaves.

If you now should draw a diagram illustrating by means of a surface of frequency these results, that diagram would be in the form of a bell-shaped curve. At the left the curved line would be very slightly above the base line, indicating the small number which are very small leaves. From here it would rise rapidly, first in a convex and then in a concave curve until it was a long distance away from the base line, thus representing the large number of leaves of medium size. From this point the curve would run back again toward the base line so as to make a symmetrical figure, and at the right end would again be very close to the base line representing a small number of very big leaves. The resulting curve resembles in shape the heap that is made by dumping a load of sand out of a cart.

If now you should record the heights of 10,000 army recruits of the same race you would find a startlingly close agreement with the conditions disclosed when the leaves were measured. You would find a very few very short men; a great many middle-sized men, and a very few giants. The truism by which we commonly express this is that "most people are of about average height". If you should make a curve enclosing the surface of frequency representing the distribution of these army recruits according to height you would find it almost exactly the same as the curve representing the lengths of the leaves. Again, if you should toss a number of pennies into the air and record each time how many fell heads up and how many fell tails up you would find that very

rarely would they all fall heads up, and very rarely would they all fall tails up, and that most of the time they would fall about half heads and half tails up. If you should draw a curve representing the results of these various trials you would find once more that it was practically the same curve.

If now you test a great many third-grade school children as to their ability in spelling you will find among them very few very poor spellers; a great many medium spellers; and very few very excellent spellers. Moreover, you will find that they are distributed as to their spelling ability in just about the same way as men are as to heights, and leaves are as to lengths. The same great law of nature which controls these phenomena emphasizes its workings in a large range of physical, biological, anthropometric, and intellectual settings. Mathematical laws concerning the characteristics of the surface of normal distribution have been most accurately determined, and it is thru the application of these laws that it is possible to determine and locate the steps on the different scales for classroom performance.

Classroom scales may be divided into three classes, according to the basis on which they rest. The first class consists of scales based on a concensus of judgments. The Thorndike handwriting and drawing scales and the Hillegas composition scale are good examples. The values of the successive steps of these scales are determined by the concensus of judgments of competent judges. The second class of scales consists of those based on measurements of function. The Ayres handwriting scale is a good example in this class. Here the steps were determined by careful measurements of the legibility of the different samples of handwriting. The third class of scales consists of those based on right and wrong cases. Such, for example, are scales for measuring attainment in spelling and in arithmetic where the words spelled or the examples are considered as either right or wrong.

It is probable that a large proportion of the pedagogical scales of the future will be based on the concensus of judgments by competent judges. Now in the case of many sorts of classroom work it is hard to see how any other satisfactory basis for scale-making can be found. In drawing, English composition, music, and so forth, it is surely difficult to measure results save by means of a scale which is based on the judgments by competent judges. To illustrate how such a scale may be constructed we may consider the judgments of some of us in this room with respect to the general beauty of these six neckties which I have brought in order to illus-

trate the more important steps involved in constructing a judgment scale. Let us assume that we are to judge these neckties not for color, or length, or texture, or design, but for general good-lookingness. In order that we may distinguish them from each other let us arbitrarily fix these letters M, L, R, X, S, and T.

I will now ask six of you in turn to state which necktie you consider the best looking, which the next best looking, which the next best looking, and so on down to the least good looking. This series of six judgments makes a table like the following when we record the judgments. In each case we call the one judged the best looking No. 6, the one next best looking No. 5, and so on down to the least good looking one which we call No. 1. The judgments of six people are recorded.

6	5	4	3	2	1
X	S	M	R	T	L
S	X	M	R	T	L
X	M	S	R	L	T
M	X	S	R	L	T
X	M	S	R	T	L
M	X	S	T	L	R

If now we add up the number denoting the location of the different letters in this table we find that the highest one, that of X, scored 33; then come M with 30; S with 27; R with 16; T with 11, and L with 9. It is plain that the censensus of judgments is to the effect that X, which has the highest score, is all in all the best looking tie. It is equally plain that the concensus of judgments is that M is the next best looking and so on down the line until we get to L, which is judged to be the least good looking. We have here the beginning of the scale, and if we should take a yardstick we might begin to locate points on it by starting with our least good looking necktie, which is L, and hanging it on the yardstick at the nine-inch mark. We can then hang up T at the 11-inch mark; R at the 16-inch mark; S at 27; M at 30; and X at 33. Here we have the beginnings of a scale which goes not only from lower qualities to high qualities, but in which something of the relationship of the locations is indicated.

Now this simple method is adequate to show some of the general underlying theory, but it is not adequate to show the entire process of this sort of scale making. To begin with, if all of the judges had decided that one of the neckties was the least good looking or the most good looking, we should have been unable to

locate that one on our scale. We should have known that it belonged at one end, but not just where it was located, whether a very long way out at that end or just beyond our next specimen. Again we cannot exactly locate the steps on our scale by the simple process we have used here. The reason for this is that equal percentages of judgments have more weight in the middle of our scale than they have at the end of it. That is to say, that if we had here a scale running from zero to 100, in this particular matter that we are judging, it would require a greater difference in the beauty of two samples to bridge the gap between 90 percent of the judges and 100 percent of the judges considering it the best looking, than the amount of increase that would be necessary to secure an advance in judgment from 60 percent of them to 70 percent of them. The mathematics involved in this part of scale-making goes back to considerations of the nature of the surface of normal distribution, which can only be very briefly considered here. A third shortcoming of our illustrative scale is that we have not as yet determined its zero point.

These shortcomings are matters which for the moment we may waive in the interests of passing on to consideration of the fundamental characteristics of the other classes of scales.

It seems clear that we shall have in the future some scales based on function. As has already been mentioned, the Ayres handwriting scale is such a one. In this case the fundamental hypothesis was that the principal function of handwriting is to be read, and hence the best criterion of its goodness is its readability, which is to say its legibility. A great many samples of handwriting were then scored according to their legibility, which was determined by several thousand carefully timed readings. On the basis of these records the scale was developed.

One may readily imagine a scale for general merit of appealing letters sent out by philanthropic organizations. Such a scale might be based on the amount of subscriptions solicited by these form letters. This would be a scale based on function. In similar ways a scale of advertisements might be constructed on one of a given type of statistical diagrams.

Scales for measuring attainment in such subjects as arithmetic and spelling differ in nature from those we have been considering in that we do not commonly measure results thru a long series of progressive impressions, but rather by finding out whether the example worked or the word spelled is correct or incorrect.

An illustration of how such a scale is constructed is furnished

by a scale for measuring ability in spelling, which has just been completed by the Division of Education of the Russell Sage Foundation. The basis of this scale is the one thousand commonest words in English writing. The identity of these words has been determined by combining the results of four extensive researches, carried thru with the aim of finding out which words are most often used in our writing. After these thousand words were selected they were combined in spelling tests and sent to be spelled by children in the grades from the second thru the eighth in a large number of cities. Figures were secured showing how well these thousand words were spelled by 70,000 children in 84 widely separated cities. This involves an aggregate of 1,400,000 different spellings.

Suppose now that we consider the surface of frequency which we have here illustrated as representing 100 typical third-grade children. We will suppose that these children are ranked according to their spelling ability from the worst to the best. If now they are given the sort of spelling test we are talking about we shall find that 93 of them can successfully spell the word "have" while the remaining seven will fail on it. This tells us something definite about the location of the word "have" on a spelling scale for third-grade children. If we keep on with our testing we shall find that 69 of these children can succeed in spelling the word "yesterday" while 31 of them will fail on it. This gives us some definite information about the location of this word on our scale. If now we investigate the nature of this surface of frequency we shall find that the most convenient unit for measuring distances along its base line is one which is known as the sigma distance. This is a constant function of the normal frequency surface. It is equal to the distance from the point on the curve where it changes from convex to concave to the median line in a direction parallel to the base line. If we take this sigma distance and lay it off on the base line so that it extends just an equal distance to the left and the right of the point where the median line intersects the base line we shall have two points on our base, the left hand one of which we may designate as 40 and the right hand one as 60. If now we lay off this sigma distance two more times to the left we shall have two new points which we shall designate as 20 and as zero. By doing the same thing on the right we shall have two more points which we shall designate as 80 and 100. In doing this we are taking certain liberties with our surface of normal

MEASURING SCALE FOR ABILITY IN SPELLING

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
99	98	96	94	92	88	84	79	73	66	58	50	← SECOND GRADE													
	← THIRD GRADE	100	99	98	96	94	92	88	84	79	73	66	58	50	← THIRD GRADE										
				← FOURTH GRADE	100	99	98	96	94	92	88	84	79	73	66	58	50	← FOURTH GRADE							
						← FIFTH GRADE	100	99	98	96	94	92	88	84	79	73	66	58	50	← FIFTH GRADE					
								← SIXTH GRADE	100	99	98	96	94	92	88	84	79	73	66	58	50	← SIXTH GRADE			
										← SEVENTH GRADE	100	99	98	96	94	92	88	84	79	73	66	58	50	← SEVENTH GRADE		
												← EIGHTH GRADE	100	99	98	96	94	92	88	84	79	73	66	58	50	← EIGHTH GRADE
me do	and go at on	a it is she can see run	the in so no now man ten bed top	be you will we an my up last not us am good little ago old bad red	of be but this all your out time may into him today look did like six boy book	by have are had over must make school street say come hand ring live kill late let big mother three land cold hot hat child ice play sea	day eat sit lot box belong door yes low soft stand yard bring tell five ball law ask just way get home much call long love then house year to I as send one has some if how her them other baby well about men for ran was that his led lay	nine face miss ride tree sick got north white spent foot blow block spring river plant cut song winter stone free lake page nice end fall feet went back away paper put each soon came Sunday show Monday yet find give new letter take Mr. after thing what than its very or thank dear west sold told best form far gave alike add	seven forget happy noon think sister cast card south deep inside blue post town stay grand outside dark band game boat rest east son help hard race cover fire age gold read fine cannot May line left ship train saw pay large near down why bill want girl part still place report never found side kind life here car word every under most made said work our more when from wind print air fill along lost name room hope same glad with mine	became brother rain keep start mail eye glass party upon two they would any could should city only where week first sent mile seem even without afternoon Friday hour wife state July head story open short lady reach better water round cost price become class horse care try move delay pound behind around burn camp bear clear clean spell poor finish hurt maybe across tonight tenth sir these club seen felt full fail set stamp light coming cent night pass shut easy	catch black warm unless clothing began able gone suit track watch dash fell fight buy stop walk grant soap news small war summer above express turn lesson half father anything table high talk June right date road March next indeed four herself power wish because world country meet another trip list people ever held church once own before know were dead leave early close flower nothing ground lead such many morning however mind shall alone order third push point within done body	trust extra dress beside teach happen begun collect file provide sight stood fix born goes hold drill army pretty stole income bought paid enter railroad unable ticket account driven real recover mountain steamer speak past might begin contract deal almost brought less event off true took again inform both heart month children build understand follow charge says member case while also return those office great Miss who died change wire few please picture money ready omit anyway	except aunt capture wrote else bridge offer suffer built center front rule carry chain death learn wonder tire pair check prove beard inspect itself always something write expect need thus woman young fair dollar evening plan broke feel sure least sorry press God teacher November subject April history cause study himself matter use thought person nor January mean vote court copy act been yesterday among question doctor hear alze December dozen there tax number October reason fifth	eight afraid uncle rather comfort elect aboard jail shed retire refuse district restrain royal objection pleasure navy fourth population proper judge weather worth contain figure sudden forty instead throw personal everything rate chief perfect second slide farther duty intend company quite none knew remain direct appear liberty enough fact board September station attend between public friend during through police until madam truly whole address request raise August Tuesday struck getting don't Thursday	spend enjoy awful usual complaint auto vacation beautiful flight travel rapid repair trouble entrance importance carried loss fortune empire mayor wait beg degree prison engine visit guest department obtain family favor Mrs. husband amount human view election clerk though o'clock support does regard escape since which length destroy newspaper daughter answer reply oblige sail cities known several desire nearly	sometimes declare engage final terrible surprise period addition employ property select connection firm region convict private command debate crowd factory publish represent term section relative progress entire president measure famous serve estate remember either effort important due include running allow position field ledge claim primary result Saturday appoint information whom arrest themselves special women present action justice gentleman enclose await suppose wonderful direction forward although prompt attempt whose statement perhaps their imprison written arrange	forenoon lose combination avenue neighbor weigh wear entertain salary visitor publication machine toward success drown adopt aecure honor promise wreck prepare vessel busy prefer illustrate different object provision according already attention education director purpose common diamond together convention increase manner feature article service injure effect distribute general tomorrow consider against complete search treasure popular Christmas interest	often stopped motion theater improvement century total mention arrive supply assist difference examination particular affair course neither local marriage further serious doubt condition government opinion believe system possible piece certain witness investigate therefore too pleasant	guess circular argument volume organize summon official victim estimate accident invitation accept impossible concern associate automobile various decide entitle political national recent business refer minute ought absence conference Wednesday really celebration folks	meant earliest whether distinguish consideration colonies assure relief occupy probably foreign expense responsible beginning application difficulty scene finally develop circumstance issue material suggest mere senate receive respectfully agreement unfortunate majority elaborate citizen necessary divide	principal testimony discussion arrangement reference evidence experience session secretary association career beigbt	organization emergency appreciate sincerely athletic extreme practical proceed cordially character separate February	immediate convenient receipt preliminary disappoint especially annual committee	decision principle	Judgment recommend allege

All the words in each column are of approximately equal spelling difficulty. The steps in spelling difficulty from each column to the next are approximately equal steps. The numbers at the top indicate about what per cent of correct spellings may he expected among the children of the different grades. For example, if 20 words from column H are given as a spelling test it may be expected that the average score for an entire second grade spelling them will he about 79 per cent. For a third grade it should he about 92 per cent, for a fourth grade about 98 per cent, and for a fifth grade about 100 per cent.

The limits of the groups are as follows: 50 means from 46 through 54 per cent; 58 means from 55 through 62 per cent; 66 means from 63 through 69 per cent; 73 means from 70 through 76 per cent; 79 means from 77 through 81 per cent; 84 means from 82 through 86 per cent; 88 means from 87 through 90 per cent; 92 means from 91 through 93 per cent; 94 means 94 and 95 per cent; 96 means 96 and 97 per cent; while 98, 99 and 100 per cent are separate groups.

By means of these groupings a child's spelling ability may be located in terms of grades. Thus if a child were given a 20 word spelling test from the words of column O and spelled 15 words, or 75 per cent of them, correctly it would he proper to say that he showed fourth grade spelling ability. If he spelled correctly 17 words, or 85 per cent, he would show fifth grade ability, and so on.

Russell Sage Foundation, New York City
Division of Education
Leonard P. Ayres, Director

The data of this scale are computed from an aggregate of 1,400,000 spellings hy 70,000 children in 84 cities throughout the country. The words are 1,000 in numher and the list is the product of combining different studies with the object of identifying the 1,000 commonest words in English writing. Copies of this scale may he obtained for five cents apiece. Copies of the monograph describing the investigations which produced it may be obtained for 30 cents each. Address the Russell Sage Foundation. Division of Education, 130 East 22d Street, New York City.

FIG. 31

frequency which are explained in the forthcoming publication of the Sage Foundation describing this spelling scale (Fig. 31).

If now we erect a vertical at the point marked 20 we shall find that we have on the left 7 percent of the area of our curve and on the right 93 percent. If now we consider this surface as representing the 100 typical third-grade children as previously explained we find that we have on the left the seven children who cannot spell "have" and on the right the 93 who can. The point indicated as 20 is, then, the location of the word "have" on a scale for spelling among third-grade children. In a similar way if we erected at a point marked 40 another vertical we shall have on the left 31 percent of the surface which we may think of as representing the 31 children who failed on the word "yesterday". This point then shows the location of that word on our scale. In a similar way all of the words have been located on the scale, not only for the third grade but for all the grades from the second to the eighth. All of this will be much clearer if you will examine the copies of the new spelling scale which will be passed out.

Now I have ten minutes left, and we will use that ten minutes for questions. Does any member of the conference desire to ask a question?

Questioner: In case you want to introduce a word how would you locate it in your chart?

Mr. Ayres: Suppose we had a word not included in the thousand commonest words, how should we locate it in the chart? That could only be done fairly by having it spelled by the children in several grades in a large number of cities. Otherwise it would not be comparable, you see, with what is already on the chart. If I should do that and find out how well the children in the different cities, a considerable number of them, actually spelled it, then it is perfectly easy. We simply look it up and find the corresponding figures here (indicating) and put it in that column. No trouble at all. This chart could readily be increased to two thousand or three thousand words, so long as you do not include in it words that were misspelled not because they were essentially difficult to spell but because they were rare. Many relatively easy words are misspelled if they are not within the customary spelling vocabulary of the children. The advantage of these words is that they are all within the everyday spelling vocabulary; but the other words can be added easily if it is considered desirable.

QUESTIONER: Does the scale apply to all the grades?

MR. AYERS: The scale applies to all the grades from the second to the eighth.

QUESTIONER: What would you do with the third-grade pupil if he spelled all the first words right in the first part of the term?

MR. AYRES: We would put him in the fourth grade of spelling.

QUESTIONER: What would you do with him in the middle of the year?

MR. AYRES: Well, you would just keep on putting him where his achievement showed that he could carry the work.

QUESTIONER: Would you determine the spelling by column or text tests?

MR. AYRES: This work was all based on dictated column tests, that is, words not in sentences. I am inclined to think that there are good reasons why we are about to look more favorably on column tests than we have been doing in the past five years.

You will find a good discussion of that in a new book entitled *The Child and His Spelling,* by Cooke and Loshar, published by the Bobbs-Merrill Company. I cannot go into the merits of the controversy here and now, but for this kind of a test, in order to have conditions as nearly as possible as they were in the work basic to this scale, I should favor column testing rather than text testing.

QUESTIONER: In that book the discussion favors the column test as being easier. Is it your judgment that children will spell more readily in column testing than they will in contextual spelling?

MR. AYRES: The argument of the book is in favor of column testing resulting in better spelling than contextual testing. I think that within some rather well definable limits the argument is well taken.

QUESTIONER: Is not the ability to spell in composition the final testing of spelling, and didn't you take that test yourself when you examined those two thousand letters?

MR. AYRES: The question is, Is not composition the final testing of spelling? It is, beyond question. The final test is spelling the words in writing for an actual use.

Questioner: That is practically the only use and purpose we have in spelling, is it not?

Mr. Ayres: The question is, Is not that the only purpose we have in spelling? Practically it is. I am sorry to say that the time is exhausted.

Mr. Hines: The last address of the morning is on the subject of "Educational Diagnosis", by Dr. S. A. Courtis. Ladies and gentlemen, Mr. Courtis.

EDUCATIONAL DIAGNOSIS

Mr. Courtis: Mr. President, ladies, and gentlemen, members of the conference, I took up with you yesterday the question of the use of standard tests for the purpose of supervisory control. Today I want to continue that discussion from the other side of the story, the use of tests by the teacher; and I have given the title "Educational Diagnosis" to this lecture because it expresses better than any other phrase I know the point that I want to make;—that the teacher needs to determine by measurement the exact causes of failure in children and to plan the drills and teaching accordingly. I shall try to make that point plain as we go thru with the results I have to show you this morning.

I want to resort to the idea that Dr. Ayres used yesterday, that education, teaching, is a manufacturing process in which we attempt to take the raw material, the child, and to make out of it a certain finished product. That is, in your minds, I want to reduce the teaching process to its lowest term. Let us get it down to a situation of this kind, where we can see that we are trying to make a change in a certain material in order to get a certain product, and that there are acting not only the forces which we exert, but also other forces outside of those under our control. These act either with or against the forces which we employ.

Now manifestly, if we have forces like these (indicating) which are acting against the efforts that we are making, it becomes important that we know what those forces are and how to control them; and if there are forces like these (indicating) which are acting with ours, we want to learn also how to control them. And the point I make today is that by educational diagnosis I mean the determination of these various forces and their control under the conditions of the class work.

Now what are the factors which control the efficiency of teach-

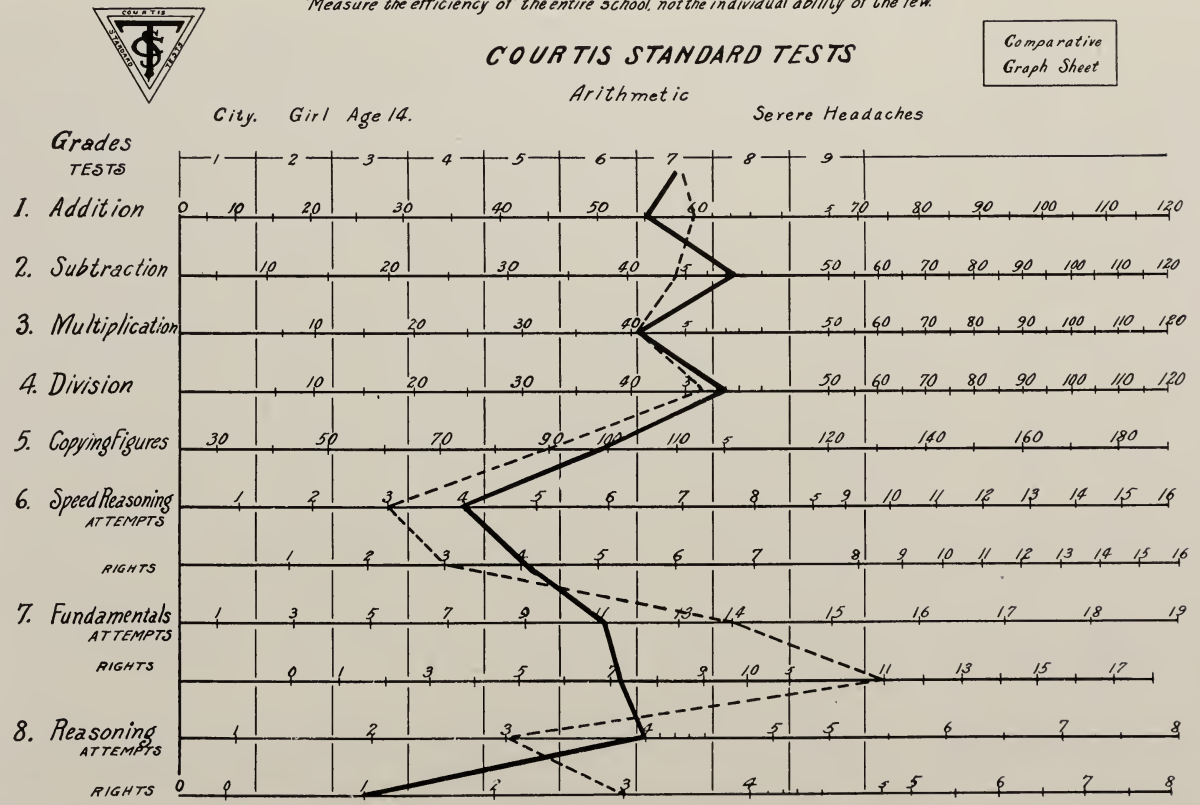
"Measure the efficiency of the entire school, not the individual ability of the few."
COURTIS STANDARD TESTS
Arithmetic
Comparative Graph Sheet
City. Girl Age 14.
Severe Headaches
Grades
TESTS
1. Addition
2. Subtraction
3. Multiplication
4. Division
5. Copying Figures
6. Speed Reasoning
ATTEMPTS
RIGHTS
7. Fundamentals
ATTEMPTS
RIGHTS
8. Reasoning
ATTEMPTS
RIGHTS

FIG. 32

ing? I have listed them here as I know them, and I have put them in three groups. The child, first of all, is determined, as I tried to show you yesterday, by his heredity; is determined in part by his maturity and by his past training. Those factors are totally in the past and are beyond our control. We must take the child as we find him. We have a second set of factors which I have listed here as present. That is the child's present physical condition, his mental and emotional condition, and I shall try to show you that these conditions affect results. I listed these as much as anything else to emphasize the point that before we can hope to make our teaching effective we must determine what has been accomplished by past teaching and what the present conditions are. Then we can plan intelligently the proper way to continue the process. Just as soon as we begin to teach, however, we begin to produce changes; and consequently there must be all the way thru a continual measuring, a continual determining of the effect of these factors, as we plan for the future. That is, teaching, in order to be efficient, must bring in this continual effort to find out where the child is, what condition he is in now, what the effect of the things that we do to him is. So that in the whole of this process thru here (indicating) I want you to get the point, as far as I am able to make it, that our work is absolutely conditioned by these factors which influence the child; and only when we adjust our work to those factors can we possibly make progress. You know very well that the laws of gravitation are absolute in their operation. You do not try to go against them. You know that the mind of the child is specialized by his inheritance and by his maturity, and you know also the effect of training. How can you begin to teach until you have determined precisely where the child stands in relation to the ends for which you are working?

Let us consider some of these factors.

Take the physical condition of the child. Fig. 32 is the record of a girl fourteen years old whom the teacher reported as having severe headaches during the whole of the term. This was her record, this dotted line, at the beginning of the year. These are the names of the tests out here. We will not stop to go over them in detail. It is enough to say that they represent eight tests in arithmetic, and this girl was about a seventh-grade girl. If you follow this line thru you can see her standing at the beginning of the year (indicating). Now what was the result of her work for six months? It is shown by this other line (indicating). A little progress there. None there (indicating). Lower score here (in-

dicating) and here and there are the important tests. She has made a very little there (indicating), and she has large losses in most of the other tests.

That is typical, not of a few girls but of many, many children. We have learned that we need to sort out of our classes those who are mentally incompetent to do the work we have planned for any grade. One of these days we shall learn also that we need to sort out of the class those who are physically incompetent to do the work which we have laid out for them. There are many, many children in the schools who are absolutely incapable of doing the work of the term on account of their physical condition, by reason of physical ills which prevent their successful work.

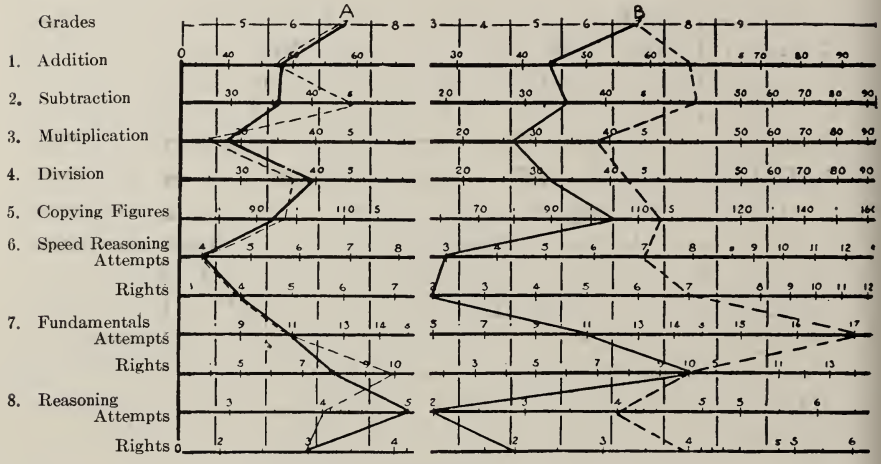

FIG. 33

The same thing is true in Fig. 33. Take the record of these two girls from the Ethical Culture School in New York City. Look at this record in those cases. The solid line represents the record at the beginning of the year, and the dotted line represents the record at the end of that year. That is, the progress in this case was made from October to May. Look at the story in this case (indicating). In the same class, under the same teacher, of course, under the same conditions; and yet look at the difference in the results. What is the explanation? It is a very simple one. On this side is a child of foreign parents, an only child, a child of rich parents, a child not interested in the school work, a child with many outside distractions, with no incentive to effort in school. The girl on this side, however, was given a year in this private

school by a relative, and considered that year a year of special opportunity. She worked faithfully thru the year, making the very most of her opportunities; and it was the girl's conscious coöperation with the efforts of the teacher which produced results like this. The question of motive comes into our work all the way thru the school, and only as we can secure the consent and conscious coöperation of the children in the work which we plan for them will we get results like this.

Fig. 34 is another illustration of the same thing. This record resembles the other in that after six months' work this girl has much lower scores and her curve now falls in this column. The only place she had gone ahead is in the test on copying figures, which involved no mental work,—where speed is determined practically by maturity. Since the girl is six months older she has a slightly higher score at the end of the year. In everything else she has gone backward. What was the reason? It is her third year in the grade. If they keep her there long enough I think she will get into the kindergarten, or the school for feeble-minded. This result is typical of what often happens when we make children repeat a grade.

We have a big problem, a problem we need to watch and work out very carefully. It is not enough to say that the child failed. We want to know the precise reason why he failed, whether from causes which are within the school's control or from those beyond the school's control. If the causes are within the school's control then the school is responsible for the child's failure; and the mere repetition of the work, without discovery of the reason why he failed, or without a remedying of the conditions under which he failed the first time, is, from my judgment, criminal.

I suppose very few of you have any idea of the effect of the various factors which are acting upon children when they are doing their work in school. Here is the record, for instance, of a person taking a simple addition test, just the addition of two figures, the addition combinations (or the multiplication combinations), taking such tests every fifteen minutes from half-past six in the morning until eleven o'clock at night. Starting in about half-past six, he has a score like this (indicating); about sixty-five. The second test he is a little lower; the third test is a little lower; the next test is higher; and here is time off for breakfast. Note the rise and fall of the curve. There are certain periods of the day when the person's ability is at a maximum, and other periods

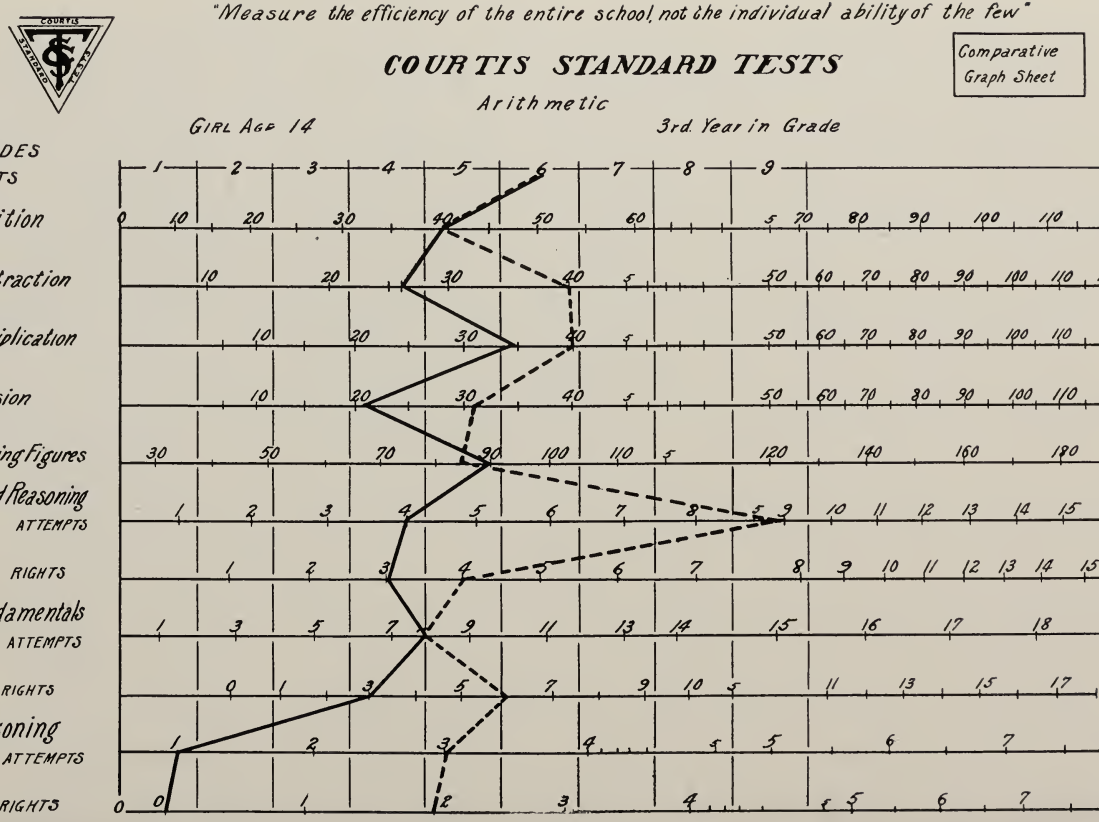
"Measure the efficiency of the entire school, not the individual ability of the few"
COURTIS STANDARD TESTS
Arithmetic
Comparative Graph Sheet
GIRL AGE 14
3rd Year in Grade
GRADES
TESTS
1. Addition
2. Subtraction
3. Multiplication
4. Division
5 Copying Figures
6. Speed Reasoning
ATTEMPTS
RIGHTS
7. Fundamentals
ATTEMPTS
RIGHTS
8. Reasoning
ATTEMPTS
RIGHTS

FIG. 34

when it falls to a minimum. There are forces acting which produce marked variations in scale.

That record was taken on May 12 (indicating). Here is a similar test, the same man, taken May 16. You notice on this day the addition and the multiplication were taken at the same time, and on this the addition and multiplication were taken at different times. You cannot follow the general trend very plainly on account of the minor variation; but you notice, if you follow my pointer, it is something like this (indicating); you will have a steady increase up here, and then a decrease, and another increase.

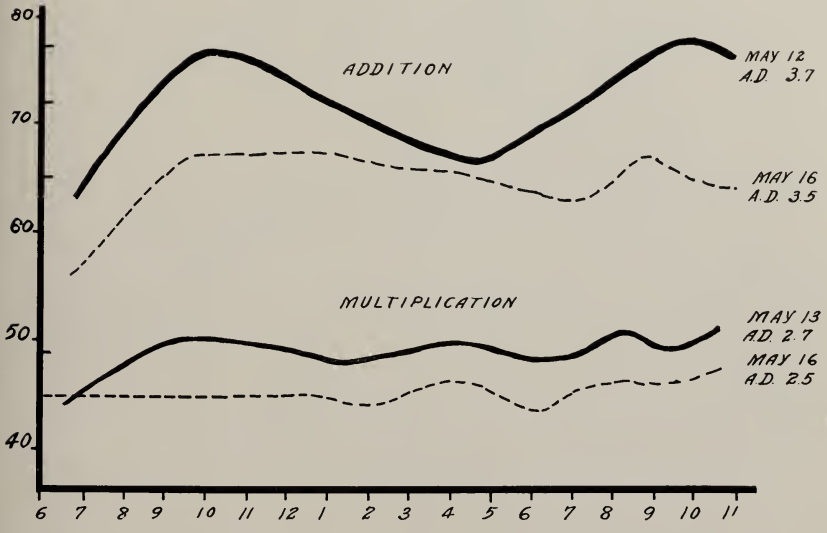

FIG. 35

In the next slide (Fig. 35) I have omitted the details and drawn only the general curve. We get a result something like this: The person began to work low. There is a period of working up towards the maximum, a decrease, and then a second maximum again. Notice that the general condition is repeated the next day. Look at this curve (indicating). See how closely these curves, taken on different days, show the same variations. They show that there are factors at work of which we ordinarily know nothing in the school room. When a child varies up and down in score from one day to another, that fact is significant. You must find out the reason for the variation. It is not enough to say the child is

variable in its performance. Let us find out the reason why, and learn how to control it.

What happens when you give the test and then repeat the test immediately afterwards? Will you get the same scores, or will you get different scores? How reliable are such scores? How

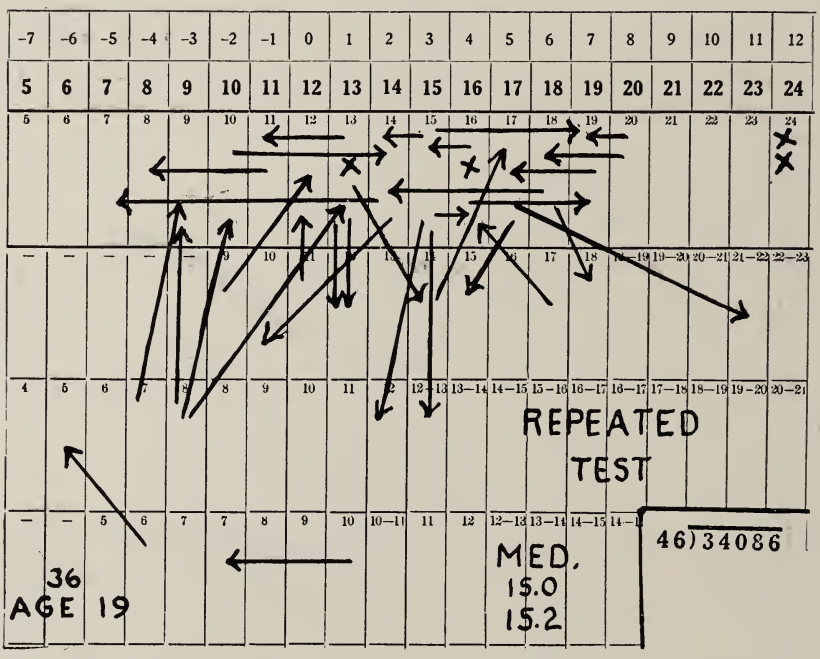

FIG. 36

well will a child repeat his performance the second time? The answer is shown on this chart of addition attempts (Fig. 36), where each arrow represents the score of one of a group of girls in the training school. The average age is nineteen. We have thirty-six girls all together, and these arrows show the changes on two repetitions of this test. That is a test made wholly on examples of this type (indicating). Notice that the median score of the class the first time is fifteen and no tenths example, and that repeating the test gives a median score of two-tenths of an example more. Notice also the individual response of these two girls (indicating). They both had twenty-four examples right both times. There is another one making the same score on the second as on the first trial (indicating). Here

are other arrows indicating other types of response. This girl did much better the second time; this one did worse. This one had a very big loss. You see the variation in response of different individuals. Some do worse, some do better; some do the same on the second test. You cannot predict at all what any one individual will do. In one sense every test is absolutely unreliable, because you cannot predict what the person will do on the next test; but in another sense every test is absolutely reliable, because if under one certain set of conditions a certain score is shown, as long as those conditions remain, the same score will be made. About sixty percent of the children will vary somewhat from the first score. About forty percent will make very closely the same score. Here is a girl, for instance, whose score varies widely. The first time fourteen and fourteen. The second time she tried only seven. When that score was written, and this score was written, her ability must have been the same. Yet one or the other of these scores is unreliable. There are only two out of the thirty-six that had such a wide variation.

You can see from these records that the response of each individual is determined by factors within that individual, and not by the conditions of the test. For eighty percent of the children the tests are absolutely reliable, but for from ten to twenty percent they are unreliable. For groups, however, the results are very constant, and the fear that some people have that mere repetition of a test will change results widely has little foundation in fact.

Consider the question of individual variation a little further. What happens during the year as you teach a class? Fig. 37 is the record for a whole year of individuals tested repeatedly with the same test thruout the year. We cannot follow it all, but I want you to notice this. We began the school in September. This (indicating) is the Christmas vacation. This (indicating) is the April vacation. This the summer vacation. This heavy line here represents the general progress of the class as determined by the average score. Here is an individual whose curve starts here and makes a steady growth; during the vacation it drops a little, and then goes up pretty high. This is the kind of curve that represents the popular conception of what happens when a child goes to school.

I want to show you other individuals, however. For instance, this one who makes a steady gain during the school term; goes home during the Christmas vacation, and comes back here regular (indicating). Comes into school again and goes home again (in-

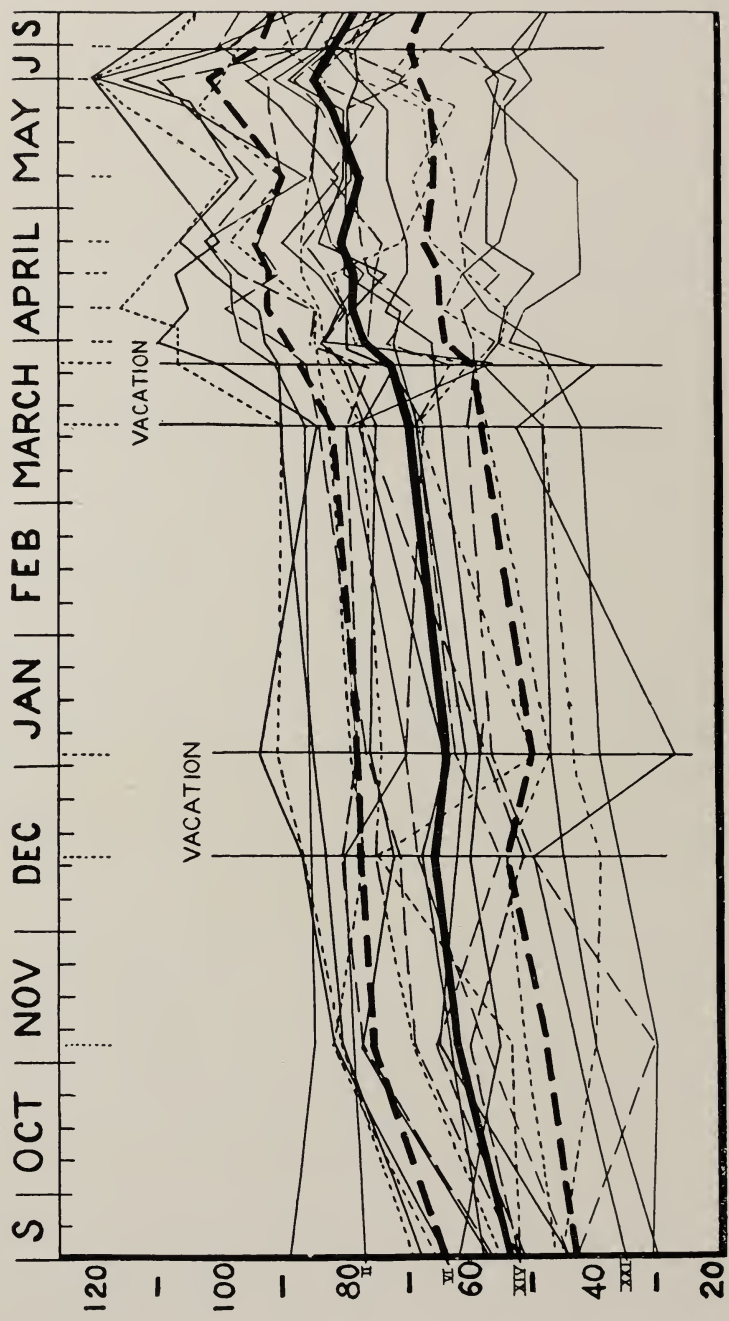
TIME SCALE WEEKS
S
OCT
NOV
DEC
JAN
FEB
MARCH
APRIL
MAY
J
S
VACATION
VACATION
120
100
80
60
40
20
II
VI
XIV
XIX

FIG. 37

dicating). If we could only keep her in school we could probably get her somewhere. The social attractions, or distractions, at home are too great for permanent results.

Just notice the effect of these variations in addition. You see how each child is responding in his own way. There is not a single situation where you can say that the children all respond the same way. The individual variation is too great.

I presume nothing that I can say can possibly convey to you an understanding of the extent of this specialization of the individual mind. It is only as you have worked with children and measured them in many ways that the conviction finally comes that each child is *really different from every other child.* Take the case of response to these division combinations. Fig. 38 is nine divided by three. How long does it take to write the answer and move your hand over to thirty-two divided by eight? What is the relative difficulty of these different divisions?

For this test we used an electric pencil that made a tracing like this (indicating). You can see the top line is marked off into seconds; each mark is just one second apart. Here is the time when a person is writing three. Here is the space for eight; the time a person is writing eight. These spaces are easily measused so that in the lower part of the diagram we have the record

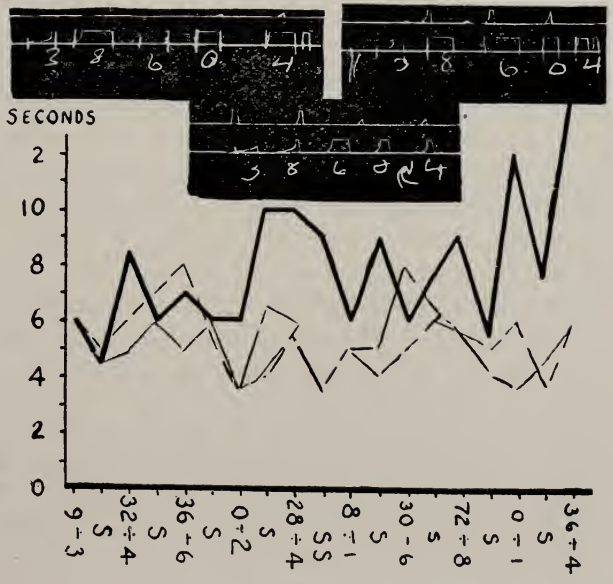

FIG. 38

in seconds. Following this heavy line you will find it took the person six-tenths of a second to write three. It took forty-five hundredths of a second to think of eight, and then about the same time to write it; and so on thru.

You notice that something happened here (indicating). See what it is. Coming to the combination of zero divided by two, he had to substitute a conscious response, in place of an automatic response and it disturbs his whole thinking machinery to such an extent that his reaction time increased greatly. You see the same thing happened here (indicating).

Now, if you will compare these other curves which represent three individuals—I think that line (indicating) is my own—you will find that each of us has his own record, his own peculiarities; and these peculiarities persist thru many weeks. It is not a chance thing, but a regular thing. All of you have your own peculiar difficulties with these different combinations, and would respond in your own peculiar way. What makes this, I don't know. I have some idea about it, but I cannot stop for that now.

The point is that as a general rule the person's reaction along the heavy line is about six-tenths of a second; but you see there are variations from it, and those variations occur for different people in different places. No two combinations have the same relative difficulty for different people.

So, when you have a child who fails to do any kind of work it is not enough to give a snap judgment, an off-hand reason. Each case calls for careful scrutiny. Take the question of failing in column addition. If you go into a classroom you often find there, by actual tests, children who cannot add examples like this (indicating); and nine times out of ten the teacher says the child does not know his combinations; that the child needs to study his tables. I used to think so, but it is very easy to prove that almost all such work done on tables is waste effort.

We have a test for the fundamental combinations in addition like this (indicating). We want to know how many answers per minute a person can write, and here is a scale which represents the number of answers per minute in such test. Then we try the same person on these long column addition examples. Is there any connection between ability in the combinations and ability in column addition? Let us see what the results show. Here are two individuals: one did forty-one and the other forty-four answers per minute in the combination test. One is able to do eleven of the long examples and have nine right. The other has five only and but one right.

Graphically, it is like this: This is the score of one; this is the score of the other. Then look at the curves of these two other individuals. Their scores in the combinations are sixty-two and sixty-three. That is this point on the scale (indicating); but this one does very poorly on the long columns while the other one has nineteen tried and nineteen right.

Look at this one who is able to write combinations at the rate of eighty-seven. He tried only sixteen and had only six right. Do you suppose it would do him any good to study his tables any more? Not a bit.

Do not misunderstand me. Everybody has to learn the combinations. There is no mistake about that. The only question is how they are to be learned, and the results here, in connection with other measurements, show very plainly that it is a waste of time to teach children their combinations in tables. There is only one efficient way for children to learn the combinations, and that is by practice in column addition. The child that does not know the combinations can learn the combinations right in the column addition work; not by working on the combinations as separate tables and later attempting to transfer the skill gained to column addition.

For about seven children out of ten there is little or no transfer. You may teach them a table, but they will not know how to add or to multiply. The teaching must come directly into the situation where the combinations are used. I do not say the combinations must not be taught. They must be. But they must be taught in the situation in which they are used, and not separately as tables. I haven't time to go further now into that. I simply want to point out to you the variation in the organization of different individual minds which results like this indicate. This person does not know his combinations very well, but he is able to add splendidly. This person knows his combinations better than the first, but he is able *to add* very poorly. The difference is due, not to variation in skill in the combinations, but to the differences in the organization of the individual minds.

In one school in New York City we were fortunate in finding twelve pairs of twins in one building. That was too good an opportunity to be lost. We gathered the children in one room and gave them four simple tests of the combinations, over and over again; four trials on each of five tests—this test for addition, subtraction, multiplication, division, and copying figures.

This line represents the average score for the four trials. This curve records the results with two twins who looked alike in their faces. In the first trial both did better than their average. On

the second trial both did worse. On the third trial both did better; and on the fourth trial worse. And practically the same thing is true in each test. That is, two individuals who are exactly alike in their minds respond to a given situation in precisely the same way.

These lower curves were drawn from the records of a pair of dissimilar twins, two individuals who are unlike in minds and bodies. Notice that the scores of this one in addition fall off steadily every time he takes the test. That is, the more practice you give him the lower his scores. His twin, however, loses on

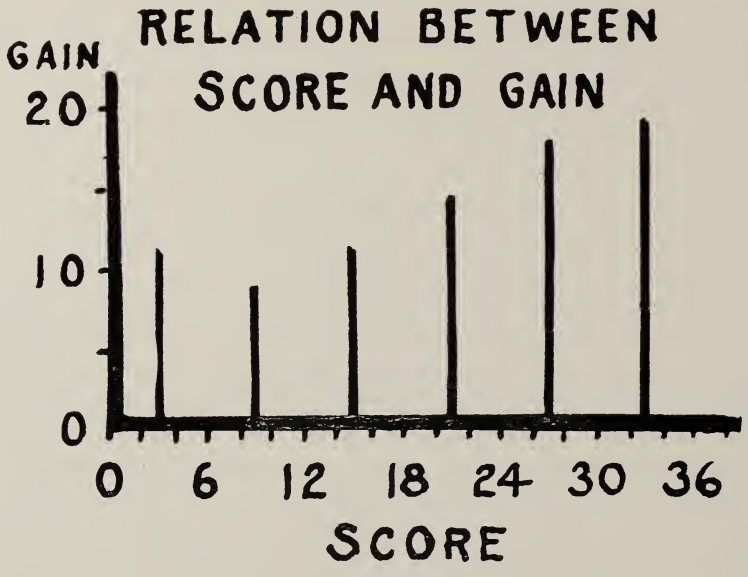

FIG. 39

second trial and then recovers. See the differences between the two in all the tests. They are opposites in their minds and in their behavior.

I want to show you something more than that. Notice that altho this first pair in addition do better on the first trial and poorer on the second, in subtraction they make low scores on the first trial and better on the second. For this individual in the second pair in addition the child's score declines, but the very same kind of practice in division makes that same child's score steadily increase. That is, the method of practice was suitable for division, but was not suitable for that same child in addition.

Thorndike has helped us understand how variable are the capacities of children and their powers of growth. One hundred and ninety-two children practiced in column addition—I think the columns were ten figures long—made these scores (Fig. 39). They practiced for something like a hundred and twenty minutes divided into various periods. Incidentally, in that study Thorndike tried to find out the relation between initial capacity and powers of growth. Here, for instance, are children who could, at the beginning of the experiment, work only about six, from zero to six, of the examples in the time allowed. At the other end of the scale are children who at the beginning of the experiment could add from thirty to thirty-six examples in the time. If you take two groups and give them the same practice, what will be their

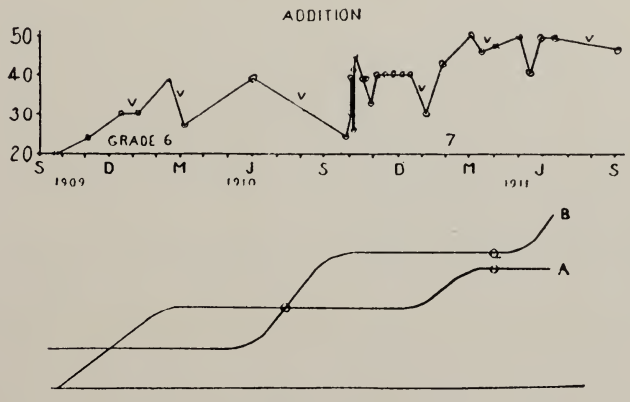

FIG. 40

response? Which group would grow the more, those who are now able to add, or those who do not know how to add?

Look here (indicating). This scale shows the gain. These children (poor) made a gain of about ten examples. These children who already knew how to add made a very big gain; that is, the more able children have the greater powers of growth. This means that if you have a class which has in it children who do not know the multiplication tables, and you give that class drill in multiplication, it is not the children who need the drill that get the benefit of that drill, but it is the children who already have high scores.

The situation is exactly like that we have in churches on the Sunday that the minister gets up and lectures the people who are present on the evils of not going to church. It is not the people

who go to church who need the sermon. That is precisely the thing many of you are doing with your classes over and over again. It is one of the things which makes for inefficient teaching, one of the mistakes to avoid.

Not only do children differ in their inherited capacities, not only do they differ in their powers of growth, but they differ in their periods of growth as well. In Fig. 40 I want to show you the record of a child thru two or three years of work. The tests were in addition. At the beginning of the record the child had a score of about twenty, and as the test went on you see there was a steady growth up to a score of about forty. Then there is a variation from that on. Then thru vacation up to this point (indicating) practically no growth from forty. The spring vacation was disastrous, and the record comes down to this level (indicating), but it soon recovers. Thru his stretch (indicating) there is a period of six weeks when the child made a score of forty each week. At this point the scores suddenly went up to a new level, and they hold that level pretty well thru that year and the year that follows. If we generalize that curve, we get something like this: a period of progress following a plateau, then another period of progress and a second plateau.

Suppose we take two children on a certain day, measure them, and find that both children measure forty. One might suppose it would be possible to treat the two children alike. Yet one of those children may respond to training in such a way that in a short time his score will be sixty; but the other child may resist training for a year or more. As an essential part of our preparation we need to determine whether or not the child is ready to grow, whether he is in proper condition for training; for it seems quite likely that this plateau means that the conditions of training were unfavorable. That is, if the training were interrupted at this point, and the test given once a week, or once a month, the plateau could be avoided, and we could get a result which would run up this way (indicating). That matter is under experimental consideration. I can make no final statement about it except that it is probable that such plateaus are not necessary.

We teachers have great faith in our professional training, great faith in our methods—a faith which is not warranted by any of the results so far secured. In one school in a large eastern city we found a master who was a firm believer in the value of the Austrian subtraction. That, you remember, is the subtraction where the remainder is found by addition. If a child wants to

find the difference between seven and ten, he thinks how much must be added to seven to make ten. The advocates of that method say that the child does not need anything new after he has learned his addition combination. He already knows how to subtract.

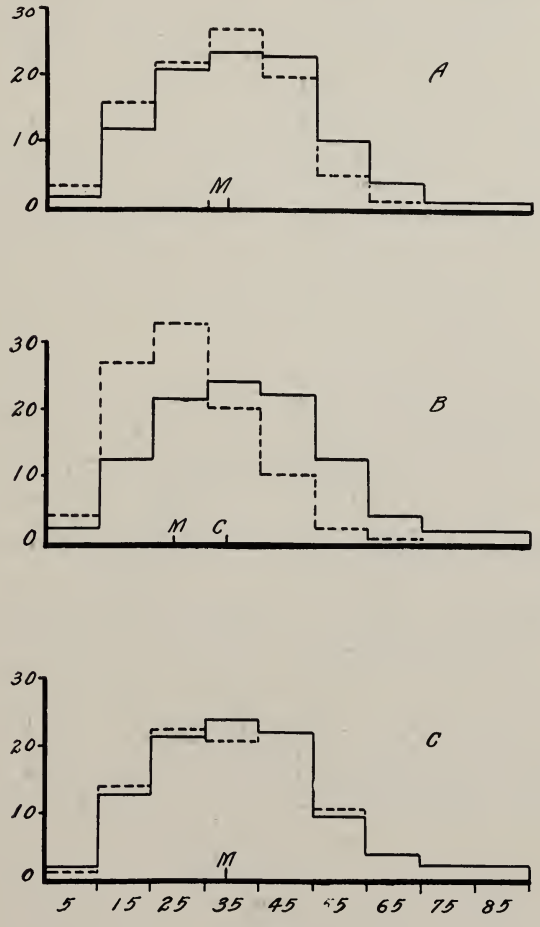

FIG. 41

We tested that. Fig. 41 is the result of the test in subtraction. This scale gives the number of subtractions worked per minute. The solid line (Fig. 41C) shows the results for the city as a whole. This dotted line shows the school in relation to the city. You see that the two curves agree closely. That is, the school's results on the whole were just average.

Fig. 41B is the record from another school where there was poor

supervision (indicating). I give this merely to show that the tests reflect any actual differences in schools that may exist.

Fig. 41A is another school that didn't teach Austrian subtraction. Notice that its results are slightly better than those of the school with the special method. So that similar results were obtained by different methods, and the Austrian method did not prove more effective than the other. In general it is easy to prove that differences in method are relatively unimportant.

Suppose we take a picture of the child's mind as completely as we can get it. Fig. 42 is the record of a single girl in twenty-four different tests. The heavy circle represents the sixth grade averages in the twenty-four tests. This waving line represents one year's departure from the sixth-grade averages as furnished by the average scores in other grades. This curve ought to mean to you that this girl was a year older than her grade; about two years

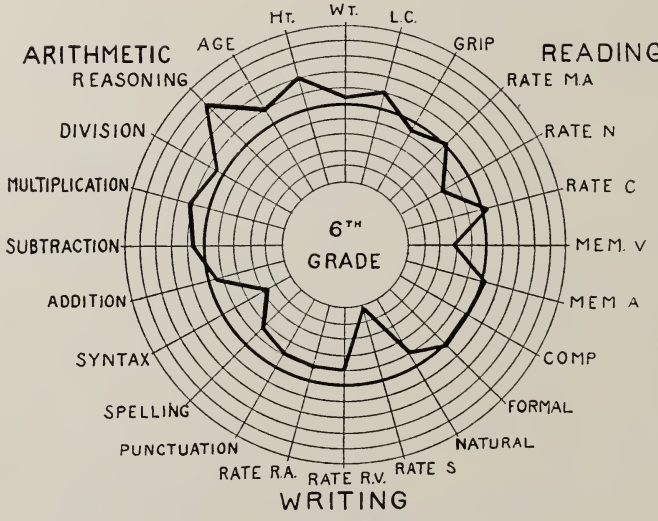

FIG. 42

taller, half a year heavier, had a year's greater lung capacity, half a year under standard in grip; about normal in her rate of motor activity, but a very slow reader. On careful reading she is up to standard, but on quick reading she is slow; she is deficient in visual memory, and very poor on her rate of English composition. But when you come to arithmetic you find she is very strong, especially on reasoning. I want you to note that the general tendency of that girl is along this line (indicating).

On Fig. 43 we have four other individuals. You can see how variable are their abilities in these twenty-four tests. That break in the curve (indicating) tells me why I was not able to

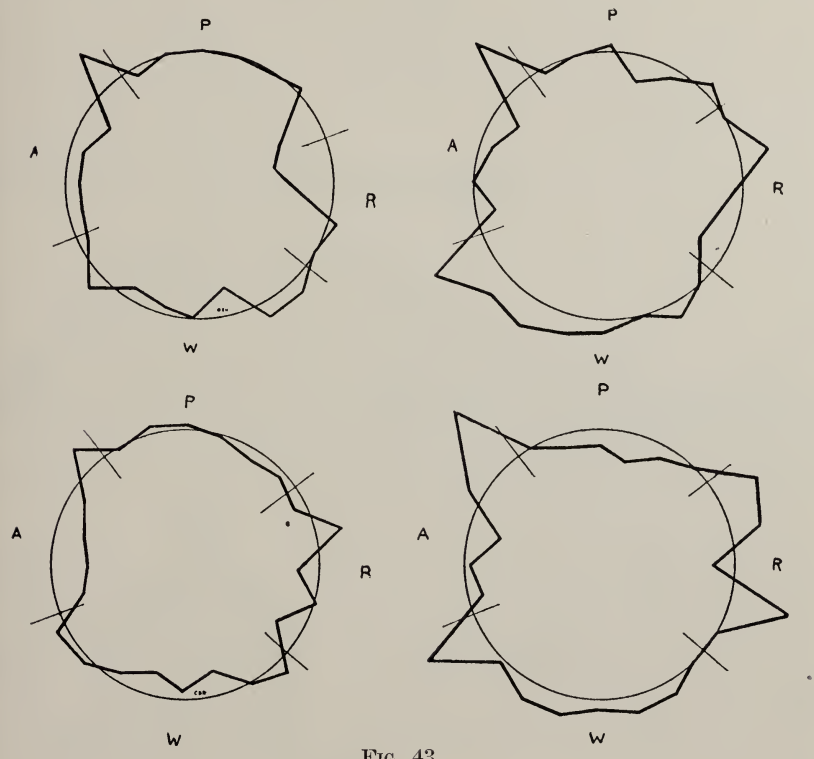

Fig. 43

teach that girl reasoning in arithmetic; she had the serious defect in her ability to read. See how this one is entirely within the circle. You could easily pick her out as the weakest girl in the class, just as you would pick this one out as the strongest. So that you have a means of diagnosis, when you get measures of this sort.

But the thing I want to call your attention to is merely the differences between these different individuals. You see how different, how specialized is the material upon which the educational process acts.

Now what is the result when we try to teach, absolutely disregarding the children's condition, and measuring our results *merely* at the end of the process? If we do that, what kind of results shall we get? Your own figures for Indiana have shown you.

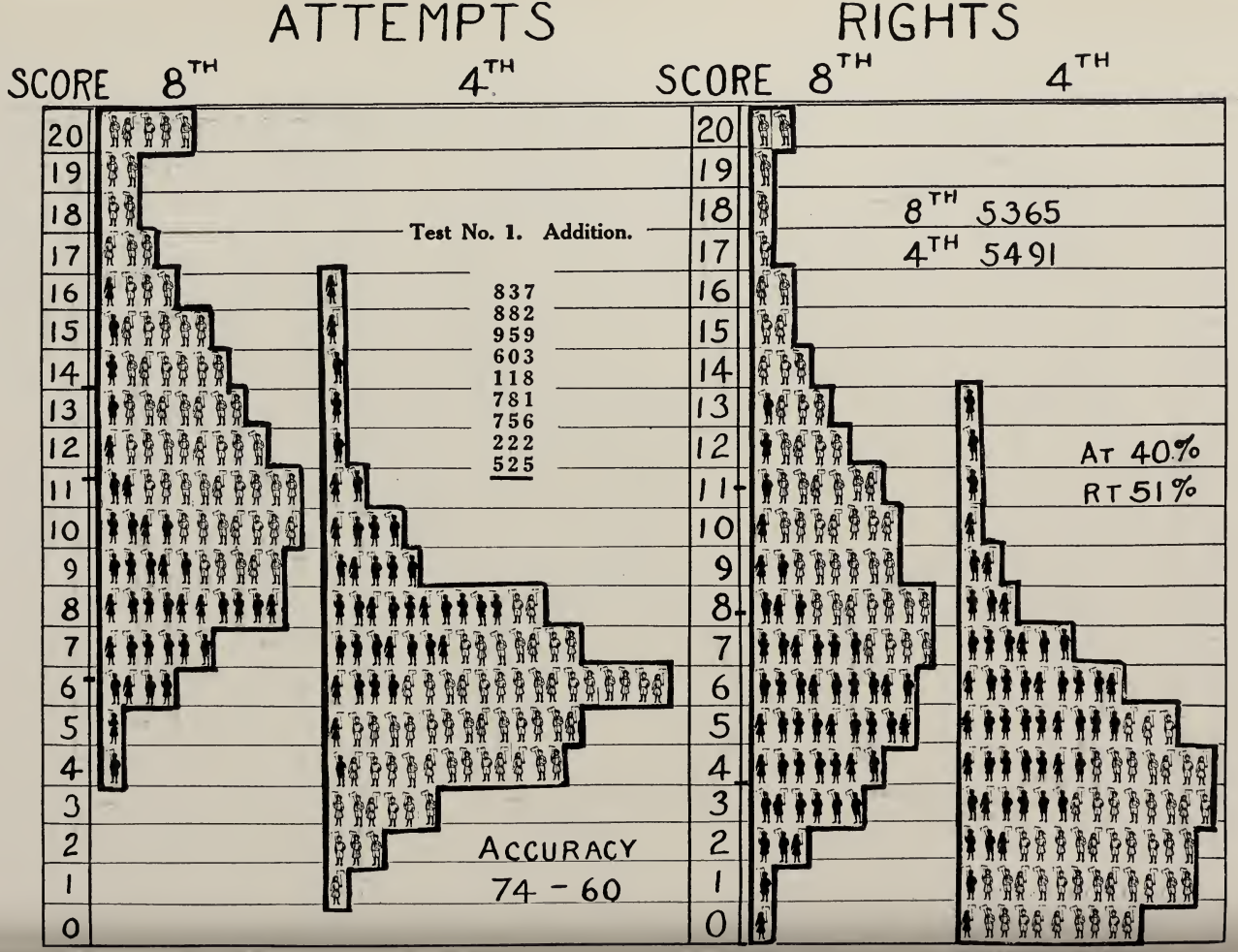
ATTEMPTS
RIGHTS
SCORE 8TH 4TH
SCORE 8TH 4TH
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
Test No. 1. Addition.
837
882
959
603
118
781
756
222
525
ACCURACY
74 - 60
8TH 5365
4TH 5491
AT 40%
RT 51%

Fig. 44 is an addition test, made wholly on examples of this type (pointing to column in the chart headed "Test No. 1—Addition"). We find that about five percent of the children are able to do twenty examples or more in eighth grade in eight minutes. The product varies down to about one percent of the children who try but four. If we consider accuracy, the product varies from two percent that can get twenty examples right, down to one percent who can get none. Just note the range of variation in the product. That result is representative of the Indiana product, of what you are turning out from your schools at present. If you take children in the fourth grade and compare them with the children in the eighth who made the same scores, you will find that about fifty-one percent of the children could be transferred from the fourth grade to the eighth and vice versa without changing the median scores of either grade in the slightest. That is, the product of school training in addition at the present time is tremendously variable. You will remember that those superintendents came up to about here (indicating 16 examples); bookkeepers and other people of that class came up to about there (indicating 20 examples); and thus all these children had comparatively adult ability. In the eighth grade, on the other hand, you have children who fall below the fourth-grade level. You have four or five percent of eighth-grade children that made lower scores than the average of the fourth grade. That is, when a child says he has completed the work in the schools thru the eighth grade you can tell nothing about his ability in addition. He may be very skillful, or helplessly incompetent.

Precisely the same thing is true in every subject that has yet been tested. Fig. 45 is a question of reading in the eighth grade. One hundred and sixty-three children collected from classes in, I think, five different cities average in the rate of reading from four hundred words per minute down to forty words per minute on the same material, under the same conditions. This (M4) is the fourth-grade average, that (M8) is eighth-grade average. The difference represents four years' work and is about one-third the range in the eighth grade alone. You see what an ungraded class that eighth grade is.

The graph headed "Writing" is an examination on English composition. Here (M4) is the fourth grade average. In that grade it varies from twenty-eight words per minute down to four words per minute.

If you take it in reproduction it is a little better. You see that

the difference between the fourth and eighth grades is wider. But even here you have a range of from thirty-four words down to seven words per minute.

In spelling we have a similar range. Taking this English composition, which is the only true measure of spelling, we will find that there was only about ten percent of four hundred and fifty-three eighth-grade children who were able to write one hundred

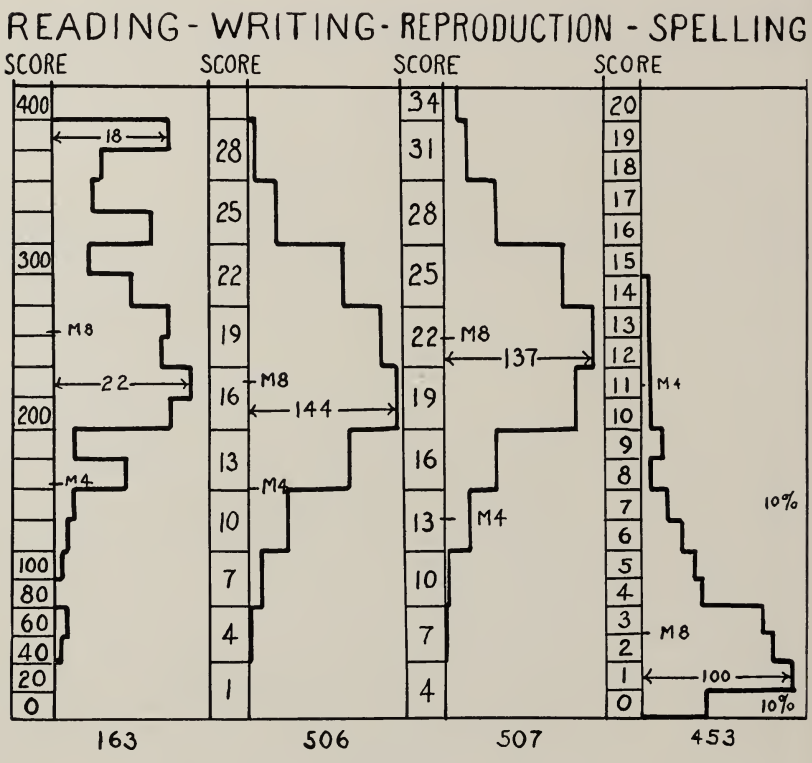

FIG. 45

words of their own choosing in this original story without making a mistake; and you will find that the median score here is about three words per hundred misspelled, while there are children who make mistakes on fourteen words. This (M4) is the fourth-grade average, this (M8) eighth-grade average. You see that in all these tests we get this same story of a tremendously wide range in the abilities of the children after they have been under our care for eight or nine years.

When we first got such results some people thought they could not be true, that there must be some mistake somewhere; but at the present time the tests have been given in so many cities and given not only at the end of the year but at the beginning of the year also, so that we have measures of growth as well. Fig. 46 shows the growth. This line represents accuracy; this, speed. Each arrow represents one child. Those had greater speed; those had less; those had greater accuracy, and those had less.

That (indicating) is one child who after six months tried seven examples less than he did before, and had seven less right.

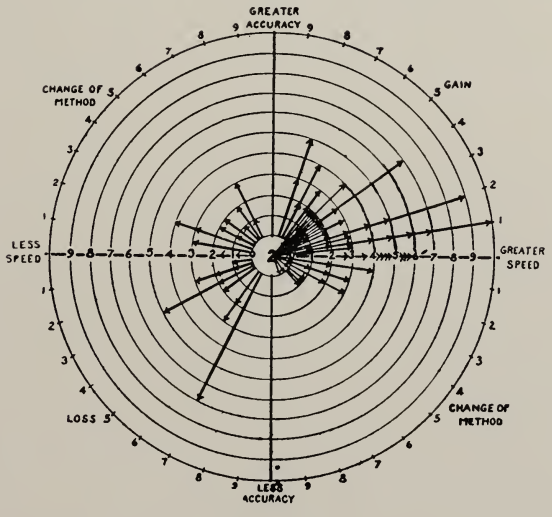

FIG. 46

This arrow means that there was one child who tried nine examples more and had more right. You see how variable are the responses of the children. About twenty percent are losing. You get about thirty percent more standing still. We have about twenty-five percent who are gaining, and from fifteen to twenty-five making satisfactory progress. That is true in city after city and I doubt not at all that your tests in this State will show a similar condition.

Now of course these things I have been showing you mean that the school work as at present conducted is tremendously inefficient. I estimate the efficiency at from fifteen to twenty percent; that is, about fifteen children out of a hundred get the benefit from their school work that they really might be expected to get from the

number of hours that they spend in school. Some people find that discouraging. You ought not to. Every test which has been made tends to show that never in the history of schools have the schools been conducted more efficiently than at present. Take the results shown in this slide and other results of the same character—you probably know about the Springfield test. In this case, Norwich, Conn., examination papers were found that had been given in 1862. They were given in the same schools in 1909, scored in the same fashion, and to the same grades of children. Those scores (indicating) represent the scores made in history and geography and grammar in 1862. Our present score in 1909 is up there (indicating). And what is more, the average age of our children is fourteen, and then the average age of the class was fifteen. There is nothing to be discouraged about in that. It simply means that our work has been conditioned by factors about which we knew nothing, and could not know until we had a means of measurement.

To my mind the inefficiency of the school is simply an opportunity for making a great contribution to the progress of our work. It is a call to service. I do not see why anybody should be discouraged as long as it is not our fault. It will be our fault if we go on doing the same old things when we have the means of doing better; but the present conditions are not a reflection upon anybody at the present time. We could not do any better until we had measurements. The savage man, the cave man, did not do very well in the construction of their crude machines before they had units of measurement; neither can we do well in education until we get units of measurement; but when we get them you will find these curves will go steadily upward. You will find not a little advance here and there, but a great advance and a great increase in the efficiency of the schools.

What about the program for efficient teaching? I am glad to say that at the present time we have worked around until we have a very definite program upon which we are basing our constructive work, and that program is here before you. The first thing is, as I am trying to make plain, that we must define in objective terms precisely what we are working for. The second thing is that we must accept the doctrine of limitation of training, which goes with definition of aim. The third one is that we must recognize individual differences in children and adjust our work in accordance with those differences. If we do that it will call for a specialization of training for each child.

And then we need to find out exactly what is the matter with each child that does not grow and apply the proper remedies. When we come to drill work, we must divide the work properly between the teacher and the class. The children must do the work and not the teacher. That is, we must have a self-direction of drill work.

Now of course the point of "definition of aim" is the most important one at the present time, because the first step is to have a clear idea of what is to be accomplished. Each aim in the school work should be stated in objective terms, so that no one can misunderstand what is wanted. If I say for the eighth grade that in June fifty percent of the class ought to be able to do twelve of those addition examples (Fig. 47) and have all twelve right I have given an aim that is perfectly definite.

I don't know how many should be right, and I put it at one hundred percent until I find out. I am not saying that twelve is right. If you chose to set it at nine here in Indiana that is your concern. Boston has set its own standard. In Detroit we have adopted twelve, and a hundred percent accuracy as the goal toward which we are working; and I expect to see an efficiency in a year or two of sixty or seventy percent on that basis.

Now when we have standards of that kind and then we find a girl in a class where the class has a record like this (Fig. 48, irregular broken line) and the girl has a record like this (Fig. 48, solid line), which means that she is very strong on multiplication, away above the class, but very weak on subtraction, we must invent methods which will enable us to specialize the training, and excuse her from multiplication in order to build up on subtraction; give her just the work she needs; not the work the class is doing.

This girl is away below the class. She needs first-grade work, even if she is in the seventh grade in subtraction. We must give her the work within her power until we build her up to the class. The minute we do that we get results like this (Fig. 49), where we have a uniform product; uniform because we have adjusted the training to the individual needs; not uniform because we compelled the child to conform to an arbitrary standard.

Now how are you going to handle, how is the teacher going to take fifty children, make a change in the method to be followed in addition, subtraction, multiplication, and division, if necessary, and vary the training according to the conditions of growth of the child and its inherent capacity?

Measure the efficiency of the entire school, not the individual ability of the few.

Arithmetic. Test No. 1. Addition.
Series B.

SCORE
No. Attempted .....
No. Right .....

You will be given eight minutes to find the answers to as many of these addition examples as possible. Write the answers on this paper directly underneath the examples. You are not expected to be able to do them all. You will be marked for both speed and accuracy, but it is more important to have your answers right than to try a great many examples.

927	297	136	486	384	176	277	837
379	925	340	765	477	783	445	882
756	473	988	524	881	697	682	959
837	983	386	140	266	200	594	603
924	315	353	812	679	366	481	118
110	661	904	466	241	851	778	781
854	794	547	355	796	535	849	756
965	177	192	834	850	323	157	222
344	124	439	567	733	229	953	525

537	664	634	572	226	351	428	862
695	278	168	253	880	788	975	159
471	345	717	948	663	705	450	383
913	921	142	529	819	174	194	451
564	787	449	936	779	426	666	938
932	646	453	223	123	649	742	433
559	433	924	358	338	755	295	599
106	464	659	676	996	140	187	172
228	449	432	122	303	246	281	152

677	223	186	275	432	634	547	588
464	878	478	521	876	327	197	256
234	682	927	854	571	327	685	719
718	399	516	939	917	394	678	524
838	904	923	582	749	807	456	969
293	353	553	566	495	169	393	761
423	419	216	936	250	491	525	113
955	756	669	472	833	885	240	449
519	314	409	264	318	403	152	122

Name..... Grade.....

FIG. 47

Measure the efficiency of the entire school, not the individual ability of the few.

COURTIS STANDARD TESTS

IN

Reading, Writing and Arithmetic

ARITHMETIC
Series B

INDIVIDUAL SCORE SHEET

Name Jennie, Girl (BOY OR GIRL), Age last birthday 13

School —— Grade 7 B Room

City —— State Mich. Date 11-12-13-11:15

SCORES

TEST	SUBJECT	ATTEMPTS 1st Trial	ATTEMPTS 2nd Trial	ATTEMPTS Change	RIGHTS 1st Trial	RIGHTS 2nd Trial	RIGHTS Change	CLASS 1st Trial	CLASS 2nd Trial
No. 1	Addition	8			2			9-4	
No. 2	Subtraction	2			0			9-6	
No. 3	Multiplication	13			10			8-4	
No. 4	Division	7			4			6-5	

GRAPH.

ADDITION Attempts	ADDITION Rights	SUBTRACTION Attempts	SUBTRACTION Rights	MULTIPLICATION Attempts	MULTIPLICATION Rights	DIVISION Attempts	DIVISION Rights
20	20	20	20	20	20	20	20
19	19	19	19	19	19	19	19
18	18	18	18	18	18	18	18
17	17	17	17	17	17	17	17
16	16	16	16	16	16	16	16
15	15	15	15	15	15	15	15
14	14	14	14	14	14	14	14
13	13	13	13	13	13	13	13
12	12	12	12	12	12	12	12
11	11	11	11	11	11	11	11
10	10	10	10	10	10	10	10
9	9	9	9	9	9	9	9
8	8	8	8	8	8	8	8
7	7	7	7	7	7	7	7
6	6	6	6	6	6	6	6
5	5	5	5	5	5	5	5
4	4	4	4	4	4	4	4
3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0

INSTRUCTIONS. In each column mark the number that corresponds to your score for that column. Then with a ruler draw a line from each number so marked to the next. Draw a curve for the class scores in the same way, using a dotted line. By comparing the two curves you can tell how much your scores are above or below the class results.

FIG. 48

We know right away it is absolutely impossible, and these results very often seem staggering to people who consider this problem for the first time. But really it is not as bad as it seems. It is simple of solution. Why not let the children choose their own

ADDITION		SUBTRACTION		MULTIPLICATION		DIVISION	
Attempts	Rights	Attempts	Rights	Attempts	Rights	Attempts	Rights
20	20	20	20	20	20	20	20
19	19	19	19	19	19	19	19
18	18	18	18	18	18	18	18
17	17	17	17	17	17	17	17
16	16	16	16	16	16	16	16
15	15	15	15	15	15	15	15
14	14	14	14	14	14	14	14
13	13	13	13	13	13	13	13
12	12	12	12	12	12	12	12
11	11	11	11	11	11	11	11
10	10	10	10	10	10	10	10
9	9	9	9	9	9	9	9
8	8	8	8	8	8	8	8
7	7	7	7	7	7	7	7
6	6	6	6	6	6	6	6
5	5	5	5	5	5	5	5
4	4	4	4	4	4	4	4
3	3	3	3	3	3	3	3
2	2	2	2	2	2	2	2
1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0

FIG. 49

method? Are you willing that I should dictate what you should eat, for instance, this coming week? Will you let me select your reading, or any other one of those things which you personally choose? Let the children decide the same way. Put here before them a perfectly definite task and let them work towards it.

COURTIS STANDARD PRACTICE TESTS. LESSON NO. 1—ADDITION

				5					10		
6	8	4	2	5	6	4	3	4	4	9	5
3	4	7	4	0	7	2	6	9	2	6	0
1	7	4	6	2	5	3	8	6	9	8	6
–	–	–	–	–	–	–	–	–	–	–	–
		15					20				
1	8	3	7	7	1	5	5	5	1	8	7
8	1	4	2	0	7	2	1	9	3	7	5
3	5	9	4	1	7	6	9	2	9	8	2
–	–	–	–	–	–	–	–	–	–	–	–
25						30				35	
6	5	3	7	8	1	6	8	6	4	3	7
5	2	9	5	0	8	7	1	2	8	8	6
5	6	8	4	8	9	6	3	1	5	7	6
–	–	–	–	–	–	–	–	–	–	–	–
			40					45			
9	7	4	9	9	5	5	2	4	7	3	8
3	0	4	7	6	6	1	4	5	2	9	9
2	4	8	3	5	9	6	8	9	8	9	3
–	–	–	–	–	–	–	–	–	–	–	–
	50					55					60
4	3	4	5	9	4	4	1	5	9	6	5
7	4	9	1	7	9	3	3	1	2	5	4
4	8	7	8	0	3	1	8	5	3	8	7
–	–	–	–	–	–	–	–	–	–	–	–
				65					70		
8	9	5	8	5	3	3	5	9	1	3	8
4	3	0	8	3	6	3	6	7	6	9	6
0	6	8	5	2	4	1	8	5	7	4	0
–	–	–	–	–	–	–	–	–	–	–	–

The foregoing test, for instance, is the thing we give the children in the eighth grade in Detroit. We say they ought to be able to do those examples in three minutes and have every one right. In the fourth grade we give them six minutes, but they must have every one right. The first day everybody in the class takes that test. Those who are successful may go on immediately to Lesson No. 2, the test in subtraction.

COURTIS STANDARD PRACTICE TESTS. LESSON NO. 2—SUBTRACTION

				5				
19	32	14	32	12	23	35	13	31
6	7	2	3	2	9	7	1	4
—	—	—	—	—	—	—	—	—
10					15			
15	17	33	19	30	27	16	26	26
5	2	7	8	2	7	2	7	5
—	—	—	—	—	—	—	—	—
	20					25		
21	37	12	29	25	28	18	27	26
8	9	1	5	9	1	3	6	8
—	—	—	—	—	—	—	—	—
		30					35	
29	18	31	20	32	14	17	37	24
9	5	6	9	6	4	3	8	7
—	—	—	—	—	—	—	—	—
			40					45
13	38	31	27	21	19	24	14	30
2	8	7	5	5	1	5	3	3
—	—	—	—	—	—	—	—	—
					50			
21	33	20	29	32	15	26	30	
2	8	1	3	4	4	6	6	
—	—	—	—	—	—	—	—	
	55					60		
18	28	14	29	11	32	23	15	
2	9	1	4	1	9	6	1	
—	—	—	—	—	—	—	—	

Those who are not successful have to stay on the addition test until they know how to do it successfully. That is, to get every example right, that is, do thoroly the work that they are doing and do it within the time. Thus we control both speed and accuracy.

Some people object to letting the child take that test and work on it. Why, they say, he will learn it by heart. That is what I want him to do. I want an adder who has learned so many examples by heart that you cannot give him a new one he cannot add immediately. In this case, he meets a new series of combinations in lesson four—the same combinations, but a new arrangement. In lesson seven he comes to addition again. There are fifteen different types of addition problems. When he has finished the series of

forty-eight lessons he will have developed himself in all of those different operations.

Each child keeps a record of his own work, traces his records from day to day. Here (Fig. 50) are graphs of the records of a number of children. This is a curve of a child who the first day tried only forty-two of the seventy-two examples in the test. Notice

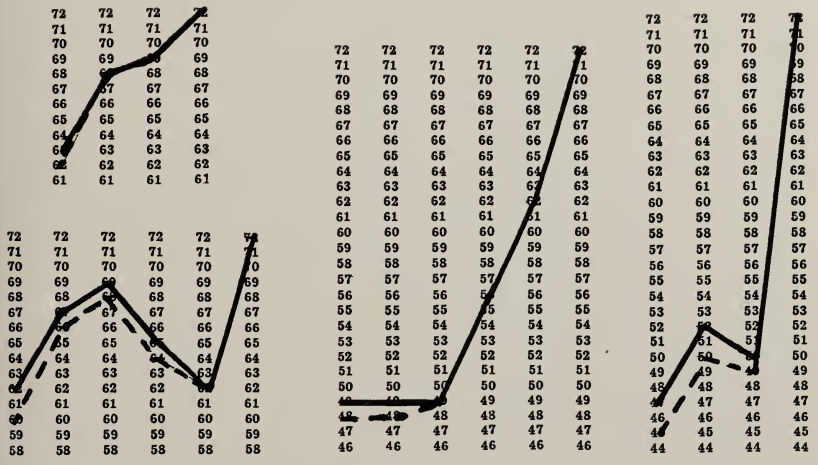

FIG. 50

that in four days he is thru and ready to begin with lesson two. But this second child was low not only in speed but also in accuracy. That inaccuracy holds until the child realized that he had to master that, and then we come down to a place like this, where he conquers it and goes on to the next test.

Look at this one. There is the same situation there. No progress here for three trials. Probably the method at first didn't make much appeal to him. A great many children don't care what the teacher says, but when Johnnie or Susie, or some one else they are interested in, begins to get ahead of them, it is another story. When he does begin to work, even tho he is down at forty-eight, he sees from his graph that he gets his gain in return for his study. This test is such a simple one that it is within his reach.

Do you notice the difference in the individual response? and do you notice now that all the teacher has to do is to say start and stop? Whether the child is working on lesson forty-eight or lesson one, the teacher can have a whole roomful working at different lessons at the same time, each child can go at his own rate, go his own way. If he chooses to study orally or visually, he pursues

his own method; and the teacher does not need to see him unless something happens to his record.

If the first study progresses like this (indicating), why should the teacher help? Why should he not be left to help himself? But if the scores become stationary then he needs help.

Here is the record, for instance, of a boy who had a great deal of trouble with lesson 1. I have lots of sympathy for that boy. That is my boy. I picked out a very able woman for his mother, but unfortunately he chose to inherit almost entirely from his daddy; consequently he has all the defects his daddy has, and I know what a struggle it takes to overcome them.

Now that boy was way low. He was fifth from the bottom of nine hundred and sixty-five of fourth-grade children that we tested in addition at Detroit this year. I have his record here (indicating). He was off the map. He was so far below that we had to tack an extension on the graph sheet to get it down low enough for his record. I took that boy and helped him as much as I knew how. I explained what the trouble was. You see the effect of the explanation.

Now that is a common defect in teaching. It does not get "across". There is no way by which you can transmit basic experience by instruction. If we could take our experience at the end of life and give it to the children just starting, the human race would advance at a tremendous rate. But you cannot transmit basic experience by instruction. It is a thing that has to come from within. When I finally came to my senses, I took the matter up with the boy and made plain to him what he needed. He agreed with me that the trouble was want of concentration. I explained it could only be overcome by his own efforts. I gave him a supply of tests and a stop watch. He agreed he would not go out to play that Saturday morning until he had made a definite gain. I don't know how many trials it took. It took about two and one-half hours, and cost some tears, but he made it, and when he went back to school of Monday that is where he was (indicating). Here is another period of stagnation, and another Saturday, and another boost. I didn't do that. The boy did it.

And look, here is the next test. He started low, but it was not long before he began to gain. Then what do you suppose the next thing was? A note came from his teacher, "Joe is improving in all his studies." Why? Because he had learned to concentrate, had mastered the one defect which was standing in the way of all his work.

That effort at concentration was *for him* the critical thing. This case illustrates perfectly what I mean. Teaching does not do any good when you have a difficulty like that to deal with. Whatever causes a difficulty, it must have some remedy which fits the case, and no other. You cannot make your teaching efficient until you become educational physicians, and apply the precise remedy which a child needs.

Do children need this kind of work? Let me show you some results. We had the tests in use in Detroit for sixty-five days. Here are the returns from 2,749. Four hundred and seventy-nine, in sixty-five days, had finished the work of the term, that is, the first twenty-five lessons. There were back here some children, ten or fifteen, who were still on lesson 2. You see the way this distribution runs in here (indicating). About one-third of the children had completed the work for the term. The rest are all the way along the line from two to twenty-four. What are you going to do with a child like that (indicating)? If he has made a gain, every day a little gain, steady progress, if he has done the best he can, and you have done the best you can, and you have arranged conditions, and yet you have only secured a very small growth, what are you going to do? Can you alter the facts any? Can you make a boy six feet tall when by nature he is only four feet? Do you expect him to be fat if nature made him thin? You know better than to try to make those changes. You don't train a bulldog to run, or a greyhound to fight. What we are endeavoring to do here is to give the children such training as will make them do thoro work. They do not go on until they have mastered the elementary things. They do not take the next step until they have mastered the thing preceding it. It makes no difference what grade they are in. They can always take the work that is adjusted to their needs, because the scheme was made for this purpose. The time allowance being the same to them all, they can work under uniform conditions, each at his own particular level.

Now what about the saving of time on this drill work?

Here is a record from an eighth-grade class. This amount of time was saved; about thirteen percent. That is shown easily here (indicating). This base line represents the twenty-four lessons that they were to complete for the term. The line running this way (indicating) represents the sixty-five lessons they had to do. This boy concluded the things he had to do in that amount of time, and he had twenty-one days left for the study of other sub-

jects, when the classes were taking this practice work. You see there is a saving of time for about half the class.

This boy completed only twenty-three lessons; this one twenty-two. This one came in late. He made a start at the beginning when he came in and had worked thru ten. The report at the end of the year is not going to say "Passed", or "Not passed". It is going to specify the degree of ability which has been attained by the school work. The report is going to say he has attained a certain level of ability. If he has gained every day and put forth his best effort, why should we condemn the child?

DETROIT PUBLIC SCHOOLS

Practice Tests in Spelling

LESSON NO. 4—A TRIP TO A GREAT CITY

On the **sixth** of December we left the Green **Mountains** of **Vermont** to visit an uncle, who had just returned from a long **voyage**.

He had acquired immense wealth by deals in **leather** and **turpentine**. We were glad to arrive in **Chicago** on the **eleventh** for we had often dreamed of this visit. But how **deceiving** are dreams. Instead of being met at the depot as we expected, we found we did not know a single man or woman in all the great crowd in the station that **evening**.

We had to **argue** with ourselves to try to **understand** how anyone could **disappoint** us on such an **important** occasion.

INSTRUCTIONS: Read the paragraphs above and study the spelling of the words printed in heavy type until you can fill in all the blanks on the other side of this sheet correctly in four minutes.

DETROIT PUBLIC SCHOOLS

Practice Tests in Spelling.

LESSON NO. 4—A TRIP TO A GREAT CITY

On the.....of December we left the	1
Green..... of.....	2
.....to visit an uncle, who had just	3
returned from a long.....	4
He had acquired immense wealth by deals in	5
..... and	6
We were glad to arrive in.....	7
on the ..... for we had often	8
dreamed of this visit. But how.....	
.....are dreams. Instead of bein met at	9
the depot as we expected, we found we did not know a single man or woman in all the great	
crowd in the station that.....	10
We had to.....with ourselves to	11
try to.....how anyone	12
could.....us on such an	13
.....occasion.	14

Scores.....Number Tried.....Number Right.....

Name..... Grade.....Room.....

The accompanying test indicates the way we are handling the spelling. A little story is printed on a sheet with the words to be spelled in heavy type. On the other side, the same story is printed with the spelling words left blank. The child writes only words as in a spelling list, yet at the same time the words appear in the natural context. The stunt is to get all the words written in the blanks correctly in four minutes (for the fourth grade). The first day everybody takes the first lesson. The second day those who succeed go on to the second lesson. Now the good spellers, the ten percent who need no training, in twenty days complete the work of the term, and have the remaining days for other work. The poor spellers like my boy take that test fifteen or twenty times before they complete it. This method points out to the teacher where the mistakes are being made, and the teacher is able to pick out the exact remedy which each boy needs. So we find that as a child goes thru with the series he gains in general ability to spell, and in his speed, on each test.

So in writing, we can divide the writing lessons for the term

into a series of twenty tests, each three minutes long. Suppose we put the test that the child shall be able to write the word men fifty times in three minutes and in quality as well as this specimen here (indicating). If you want the real value of this,—that is, measured by the Ayres scale or the Thorndyke scale, you can turn it into absolute values, but for classroom use we supply each child with a rough scale, all the same of which are based on the word men so that there will not be difficulty in judging one kind of writing by another.

Suppose the first day a boy does a kind of writing like this (indicating), the next day like this (indicating), and so on. Do you see how, if the good writers are going on in five days to lesson five, and the poor writers are still on lesson one, they have an opportunity to see the relation between their practice exercises and their writing ability? Each day at the beginning of the lesson we have ten minutes practice in which the child chooses his exercises to correspond with the particular need that he has in his writing test. Then at the close of the writing period we have a three-minute test period. We thus get the children testing their practice to see whether it has been effective or not. Just as soon as they complete twenty lessons for the term they are excused from all writing drill. They have that time for other work unless the writing in their English work begins to deteriorate. We find that in this way we can not only save time, but that the children take hold of the work and take a responsibility in it as never before. They are anxious to carry the thing thru and improve their penmanship.

In closing I want to leave with you an ideal. It may not look like much of an ideal, but it has been mine for many years. You will recognize here, for instance, in this heavy line, the distribution of which Dr. Ayres spoke. Here are a few children with very low scores. Here are a few with very high scores. That is the kind of condition we have at present. What happens when we try to teach them, particularly if we try very hard and have had a great deal of training so that we are especially fine teachers? We send some children away up there beyond the level of value in mechanical work. We also send some children lower than they would have been if we had made no special effort. The condition when we get thru is represented by this dotted line (indicating).

In place of that, if you have a definite aim and if you limit training and specialize your training to meet individual needs, you will be able to get a distribution of this kind, where, altho we have

in our classes varying abilities, we can have a uniform product and can very much increase the efficiency of our schools. But there are many, many problems to be solved before we can get to that place. That is why I want to enlist the coöperation of the teachers and superintendents of Indiana.

I know that these things are true by your own results. I want to enlist your coöperation in the invention and working out of new methods of class administration, new methods of defining what the ends are we are working for, in order that we may not have one, two, three, or twenty individuals, but many hundreds of minds at work on this problem. I have faith enough in American ingenuity to believe that this problem can be worked out, under the conditions in American public schools. I believe the time is coming when our teaching is going to be three or four times as effective as at present. Can you picture at all what that would mean for our nation? Do you realize that at the present time we have enough information in the world to bring about the millenium in the next generation if we could only make the things that we teach function in the minds of the children? I thank you.

Mr. Hines: Is there any further business to come before the conference before the noon recess?

Mr. Collicott: Mr. Chairman, I believe these meetings have been so fruitful of profit and we have enjoyed them so much that we should say something to the State University about them, and I have therefore drawn this resolution, and move its adoption:

Believing that the two annual conferences on Educational Measurements held at this University constitute the most important recent advance in educational work in Indiana, and believing that a continuation of such conferences will prove most fruitful in promoting the scientific study of education thruout the State and in unifying and uplifting the school work, therefore,

Be it resolved, by this body of superintendents, principals, and supervisors, that the University be requested and urged to continue such annual conferences; and that the Bureau of Coöperative Research of the University be urged to extend its studies of scientific measurements and standards to more of the regular school subjects, in order that the work of the public schools may be brought to the highest standards of efficiency.

I move the adoption of the resolution.

The motion was seconded, the motion was agreed to unanimously, and the conference adjourned until afternoon.

SATURDAY AFTERNOON SESSION

The conference was called to order by H. G. Brown, Superintendent of the Lebanon schools, in the absence of Mr. L. J. Montgomery, Superintendent of the South Bend schools, who was to be the presiding officer for the afternoon session.

Mr. Brown: Mr. Montgomery has been delayed for some reason, and I am asked to preside. We will go ahead with the work of this afternoon on the topic "A Survey of School Surveys". Mr. Ayres will discuss the topic.

A SURVEY OF SCHOOL SURVEYS

Mr. Ayres: Four years ago two university professors injected a new word into our educational vocabulary and introduced a new method into our educational procedure. In that year Professors Hanus of Harvard and Moore of Yale conducted studies of the school systems of Montclair and East Orange in New Jersey and each used the word "survey" to designate a section of his report.

These earliest of school surveys differed from former reports on school systems in their fundamental philosophy. Their object was to tell the people in simple terms all the salient facts about their public schools, and to rely on the common sense, the common insight, and the common purpose of the people as the first great resource in working out their problem. The purpose of the survey was to educate the public.

The two men who conducted these surveys were pioneers, but not inventors. They did not originate either the new term or the new method. They borrowed them both from the social survey movement which was at that time three years old. This movement had its inception in 1907 in the social survey of Pittsburg which borrowed its name from the land survey.

In the years that have elapsed since these early beginnings, the survey movement has grown with great rapidity, but the social survey has multiplied far faster than the school survey. The Sociological Library of New York City is now compiling a bibliography of the survey reports that have appeared in print and it has shown that while the American social surveys now number more than three hundred, the educational ones are only thirty.

The truth is that the school survey is the direct descendant of the social survey, that the two are contemporaries, and that the parent movement is twice as old and ten times as big as the offspring.

Now surveys of this new sort are always expensive of both time and money, for when rightly conducted they are dependent on truth and simplicity, which are costly. On those that have been carried thru in the past few years, sums of money mounting high into the hundreds of thousands have been expended, and to them thousands of men and women have devoted long periods of the most laborious sort of work and study.

This means that these surveys are the product of some widespread and powerful influence, for nothing is purchased at so great a price except in response to an insistent demand. This influence is not far to seek. It is to be found in one simple idea which has been taking root in the mind of the American people during the past decade and a half and which is shaping the events of the time and determining their ultimate issue. That idea is that people are more important than property.

Ever since this idea was borne in upon the American people, they have been restlessly turning upon themselves and their institutions the merciless eye of self-examination. They are asking what manner of people they really are. They are demanding to know whether justice is being done in America.

The results of this searching self-examination are to be found in the veritable flood of books and reports that have appeared in the past ten years describing the illiterate, the immigrant, the industrious; the plutocrat, the prostitute, the prisoner; the teacher, the tenant, the tramp; and so on thru the alphabet. Every part of our life is being studied, written about, surveyed.

This movement, of which the school survey is a part, is no silent, unconscious transition from one age into another. In no former period has the demand for change been so deliberate, so widespread, upon so great a scale. Education is following where the movement for social justice has led. The American nation is looking itself over from head to foot, critically questioning its very elements, challenging its oldest institutions as well as its newest, studying its every arrangement, analyzing its philosophy, and it stands ready to attempt as many and as radical reconstructions as may be necessary to attain its ends. As a nation we are seeking, and are determined to find, not a place in the sun but a more equal distribution of sunshine in the lives of all the people.

The school survey is a fraction of a fraction of this deliberate

self-examination of the full-grown nation. It is here because the people want to know the facts about their schools, and the school survey is the most efficient means yet discovered for finding them out and making them known.

There are certain definite characteristics which set the school survey apart as a distinctive implement of education and of democracy. These characteristics are in large part inherent in its very name which it indirectly takes from the land survey.

The school survey, like the land survey, is always a local study. It is concerned with conditions within a given area. It can never be thought out at a far-away desk. It is not a general treatise on education. It recognizes that each community has its own distinctive problems which must be solved by itself and are not susceptible of absent treatment.

That is why the school survey can never be thoroly standardized. That is why we can never have what many people are insistently demanding—a standard set of forms and schedules to gather for any or all cities, the figures and answers which, when tabulated, will constitute school surveys. The forms, schedules, and scales used in school surveys are like the transits, tables, and chains, used in the land survey. The more accurate they are, the higher will be the quality of result that may be produced. But they do not constitute a survey. They can never be used in just the same way in any two localities, and people do not become skilled in their use save thru long and arduous practice.

Another cardinal characteristic common to the land survey and the school survey is that the surveyors must always be competent. In the former field this has been guaranteed by legal enactment since the days of the ancient Egyptians. In making school surveys it has frequently been forgotten. It is a fundamental fact that in neither field can trustworthy results be obtained thru ready-made methods or untrained common sense. That is why it is generally true that school surveys cannot be conducted by mothers' clubs, newspapers, chambers of commerce, citizens' committees, or local bureaus of municipal research.

A third common characteristic of the land survey and the school survey is that they are both unworthy of the name if they are partisan or prejudiced. To accuse or defend, exaggerate or minimize, is as fatal in the one case as in the other. Surveys must never be like those verbs in Latin that take the dative. They must never have as their purpose to "please or displease; com-

mand, obey; serve, resist; benefit, injure; believe, threaten, persuade, and the like.''

This is why the survey is not an investigation. By common usage the term ''investigation'' suggests the indictment of individuals or institutions. It stresses failure and nonperformance. It looks backward. An investigation implies the existence of conditions known to the insider but unknown to the outsider, which are to be ferreted out and subjected to pitiless publicity. Whenever the land surveyor or the school surveyor conducts his study for the purpose of proving a preconceived case, the product is not a survey nor does it contribute to progress.

To be valid or valuable, both sorts of surveys must be scientific and both must ever remember that science is not a body of doctrine but a method and its object is the pursuit of truth. This method is at base analytic scrutiny, exact measuring, careful recording, and judgment on the basis of observed fact.

In both fields the demands of good workmanship require that the record shall show the steps whereby the conclusions were reached. All must be capable of verification so that another competent surveyor going over the same ground could check all the steps and verify the conclusions. When the surveyor steps off the sound pier of fact into the uncertain bog of speculation, he steps into trouble. This has at times been overlooked in the conduct of surveys.

On the social side, the school survey has two sets of characteristics which it owes to the fact that it is a social instrument and not to the fact that it is a surveying instrument. The first of these is that a school survey must always be coöperative. It cannot be successfully imposed from without. If the teachers and officers of a school system do not want a survey, they will not have one; at least they will not have a real one. They may have an investigation, an inquiry, and examination, and a report, but they will not have a real school survey.

The outsider who is so unwise as to go into a school system where he is not wanted, to conduct a study in which the superintendent and teachers do not have confidence, may gather many objective facts. But he will find it quite impossible to go deeper down under the surface to reach those subtler truths which concern the whole community and which constitute the materials for straight thinking about the situation.

That is why no man should ever be invited to conduct a school survey unless the superintendent and the teaching force have full

confidence in his ability to do the work and genuinely intend to coöperate with him in doing it.

The second social essential of the school survey is its public character. A survey report can never be a confidential report. It is often possible to work out far-reaching reforms in a school system by getting a group of strong men and women together around a table and convincing them that a certain course is the right one to take. This is a legitimate and often a valuable method of reform but it is not the method of the survey.

The school survey is a new and distinctive implement of progress. It has come into being for the purpose of educating the public about their schools, and its distinctive function should be preserved. It is a part of our national self-examination. It is the product of civic intelligence and community progress.

Its object is to make the entire school system pass in review before the public eye. It makes the schools and the public pay attention to each other. It presents the past, the present, and the possible. It is a community stock-taking, inventory, and appraisal of its educational assets and opportunities. It aims to place before the citizens a picture of their schools; a picture so accurate that it cannot mislead; so simple that it cannot be misunderstood, and so significant that it cannot be disregarded. It does not always succeed in its aim, but it cannot even take aim in secret or in the dark.

School surveys are never desired in cities where interest in education is dormant or in States where schools are at a standstill. Where conditions are at their best and social progress most active, the movement for self-examination is most virile. Where social conditions are darkest, it is weakest. Moreover, in a larger sense the schools themselves are responsible for the situation in which they now find themselves. During the past third of a century our expenditures for public education have grown with a rapidity scarcely paralleled in the history of the world. These expenditures pay only one sort of dividend, namely, minds that are trained to think straighter, more sequentially, more logically, more incisively. Everywhere we have been turning out more and more such minds and now they are grappling with our problems and crowding them for solution. The school survey is the product of the public resolve to know, and it can only succeed in the light and in the open.

There is but slight tendency toward uniformity in the matter

of the organizations which have conducted the thirty more important surveys that have been completed. These pieces of work have been carried thru by organizations or individuals as follows:

Individuals	7
Universities	6
Bureaus of Municipal Research	5
State Departments of Education	3
Foundations	3
U. S. Bureau of Education	2
Municipal Departments	2
National Societies	2

The most significant fact with regard to the men chosen to direct these surveys is that in most cases they have been either professors of education or special investigators and in only one case has such a piece of work been carried thru by a city superintendent of schools. The directors of these thirty surveys have been the following:

Professors of Education	13
Special Investigators	11
Directors of Foundations	4
U. S. Commissioner of Education	1
Superintendent of Schools	1

In the matter of cost the variations are even more striking than in the matter of organization. The expense involved in the different surveys has ranged all the way from $126.89 for the Waterbury, Conn., survey to a total said to aggregate nearly $125,000 for the New York inquiry. The cost figures that are available for the different pieces of survey work are as follows:

Montclair, New Jersey	$500 00
Baltimore, Maryland	2,000 00
East Orange, New Jersey	1,000 00
Bridgeport, Connecticut	1,000 00
Waterbury, Connecticut	126 89
Portland, Oregon	7,500 00
New York, New York	125,000 00
State of Ohio	10,000 00
State of Vermont	10,000 00
Springfield, Illinois	3,261 00
San Francisco, California	700 00
Butte, Montana	4,500 00

In the matter of time expended in carrying thru the different pieces of work the range is again surprisingly great. Some of the figures are as follows:

Baltimore	3	months
East Orange	2½	months
Vermont High Schools	4	months
Montgomery County	4	months
Waterbury	3	days
New York	2	years, 2 months
Portland	4	months
Ohio	8	months
Springfield	2½	months
San Francisco	3	months
Butte	1	month

Some of the surveys have been conducted by individuals with practically no outside assistance while others have demanded the services of considerable scores of highly trained experts. The available data show the following conditions:

9	surveys conducted by	1	individual.
8	surveys conducted by	2	individuals.
4	surveys conducted by	3	individuals.
2	surveys conducted by	4	individuals.
2	surveys conducted by	5	individuals.
1	survey conducted by	7	individuals.
3	surveys conducted by	8	individuals.
1	survey conducted by	12	individuals.

In the bulk of the published reports we again find extreme variation. Some of the figures showing the size of these publications in pages are as follows:

The smallest consists of six pages and the largest of 2,575.
11 less than 100 pages.
3 from 100 to 200 pages.
2 from 200 to 300 pages.
2 from 300 to 400 pages.

There are three principal modes of presentation of survey reports. In some cases the entire report is written by the director. In the instances under consideration this is the mode of presentation in seven cases. In five more the report is made up of separate chapters or sections written by experts employed to conduct specific sections of the study. This may be termed the monographic method of presentation. In fifteen cases the report is neither by the director nor monographic but is made by the investigators as a group.

This may be termed the collective method of reporting. In the remaining three cases the director and monographic methods are found in the same report.

Even in the matter of nomenclature there is as yet no uniformity in school reporting. In these thirty cases thirteen of the reports are called surveys; seven of them studies; five of them reports; two of them examinations; one an investigation; one an inquiry, and one an expert survey.

To summarize the salient characteristics of the survey it may be said that they are thirty in number; that they have all been conducted in the past four years; that they are increasing in frequency; that they have largely been conducted by professors of education; that they have largely been undertaken by agencies or individuals outside of the school systems; that they range in cost from $126 to nearly $126,000; that the time consumed ranges from three days to more than two years; and that the reports range in bulk from six pages to nearly 2,600 pages.

It is impossible to classify the surveys accurately as to their inception. Nevertheless such a classification may be made tentatively with the expressed qualification that its accuracy cannot be demonstrated. Three of the men who have been intimately connected with most of the survey work that has been undertaken recently attempted to classify the thirty surveys as to their inception and reached the following conclusions: They decided that twelve of them had their inception in a general movement for educational betterment; that seven of them were the outcome of rows; that four were started thru influences outside of the localities; that two were inspired thru politics; two by a movement for social reform, and one each by movements for municipal efficiency, the forwarding of home missions, and a city boosting campaign.

It is even more difficult to agree as to results than it is to be accurate as to inceptions. The same three men referred to in the preceding paragraph agreed that the results of these thirty surveys might be classified as bad in five cases, none in five cases, moderately good in eleven cases, and very good in nine cases.

What the future of the school survey may be, no man knows, but two indications are significant. The first is the probability that we shall have a great many of them in the near future. In the past four years two States, ten counties, and eighteen cities conducted them. At the present time there are under way or definitely projected more school surveys than all those combined

that have so far been completed. That the movement is rapidly spreading is certain.

The other significant indication is that they are steadily improving in quality. It is almost literally true that every survey report that has been published has in one or more conspicuous respects been superior to all its predecessors. This results from the fact that we began to make surveys without knowing how and we have been learning as we went along. It is well for us to remember that while we are making these inventories the methods of making them are themselves in the making.

What the ultimate results of the surveys will be, we do not know, for sufficient time has not as yet elapsed for us to judge. We have at hand, however, dependable figures showing the results of one piece of educational measuring which has become a part of the survey movement altho it was not started by it.

Just ten years ago the distinguished superintendent of schools of New York called attention to the fact that thirty-nine percent of the children in the schools of that city were above the normal ages for their grades. This aroused wide-spread investigation which showed that similar conditions obtained in other cities thruout the country. Soon studies of this phase of educational efficiency showed that the same conditions which resulted in our schools being crowded with retarded children also prevented a large proportion of these children from ever completing the elementary grades.

About seven years ago this became one of the most widely studied problems of educational administration, and in the past four it has been one of the prominent parts of the school surveys. During the entire period hundreds of superintendents thruout the country have been readjusting their schools to better the conditions disclosed.

In these seven years the number of children graduating each year from the elementary schools of America has doubled. The number now is three-quarters of a million greater annually than it was then. The only great organized industry in America that has increased the output of its finished product as rapidly as the public schools during the past seven years is the automobile industry.

It is probable that no other one thing so fundamentally important to the future of America as this accomplishment of our public schools has taken place in recent years. There is every evidence that this is the direct result of applying measurements to educa-

tion. If the school survey movement now under way can produce other results at all comparable with this one, we need have no fear for the outcome.

The educational vernacular abounds in terms to which usage has given meaning quite different from those they originally had. Witness the anomaly presented by "school", which meant "leisure", and "pedagog", which meant "slave". It is greatly to be hoped that the word "survey" will not join this company of verbal turncoats but instead will retain its meaning unchanged as the years go by. It has always meant a looking-over, and it is to be hoped that in its new educational application it will continue to mean the kind of looking-over of everything that does not overlook anything. Its future is secure if it can permanently stand for an impartial study of the schools of a community, competently conducted for the enlightenment of the public and the welfare of the children.

After some miscellaneous discussion Superintendent Brown called upon President Bryan who spoke as follows:

PRESIDENT BRYAN'S ADDRESS

President Bryan: Mr. Chairman, ladies, and gentlemen, I wish to express my hearty appreciation of the kind words respecting the University that have come from the members of this conference. I may say that it is not my purpose at this time to make an address. I wish in a very few minutes to give an expression to the spirit of the University in this and similar types of work.

We had here a week ago Mr. Robins, of Chicago, who said among other things that there are two great conflicting ideas in society. One of them is the idea of Cæsar and the other is the idea of Christ: the idea of domination and the idea of service. I believe that I express the spirit of the men here when I say that it is our wish to be moved by this second ideal and not by the first. It is not in our hearts to dominate anything or anybody, but we do wish to serve everybody; and we wish to coöperate with everybody along the lines of University work. We wish to cöoperate with the other colleges of the State, and when I say that I mean that we are actually trying to do so. We profoundly appreciate the genuinely kindly sentiments which have been expressed towards us by these sister institutions, and we count ourselves deeply bound to reciprocate that, not simply in words but in deeds.

So, for example, in our extension service we have sought and

have to a considerable extent secured the coöperation of the colleges, or some of them. Members of the faculties of those institutions have joined in the extension work. We have a feeling of very hearty coöperation with our sister State institutions, the State Normal School and Purdue University. We are not in the least jealous of anything which they are doing, either within their walls or thruout the State.

For illustration, during the past year there have been three women, one representing Purdue University, one representing the State Normal School, and one representing Indiana University, who have traveled over the State from county to county giving assistance in the field of domestic economy. There has been more work to do than all of them together could do. There is no competition or rivalry here, but there is coöperation in accordance with a well-laid plan.

And so it is in every field. All of our workers in the extension service understand that everywhere we are to do all we can to help make the extension work of other institutions succeed. There is, as I said a moment ago, in all these fields far more than all of us together can do. We believe that the most important single thing that we can do as a university is to be done within the walls of the university itself. I do not believe that the time will ever come when this will not be the case. The great functions of the University are search for the truth and the training of men and women. On the other hand, along with other institutions within and without the State, we are trying to find out a few genuine ways of carrying the things which the University has to all parts of the State; and those of our staff who have this immediately in hand are wary of undertaking things which are not genuinely worth while, and are earnestly seeking to select those things which will really justify themselves.

Doubtless some errors will be made in this or that direction, but the spirit of this effort is the fundamental spirit of the University as a world institution. That is to see and do that which is first rate. The University stands for first-rateness as distinguished from second- or third-rateness.

A few years ago William James made one of his great addresses before the Association of Collegiate Alumnae of the United States. His opening sentence was this: "The end of an education is to enable you to know a good man when you see him." There was a touch of humor in his saying this to a company of women but he said seriously that this is a sufficient definition of education.

The object of education may be expressed in that way. It is to bring you to the point where you can see the difference between what is first rate and what is not first rate in every field. If it is in the field of music it is to bring you to a point where you know at once whether that which you are hearing is classical and good, or whether it is pretentious and inferior. It is to bring you, if you are a student of literature, to the point where if you should happen to find a page of some unknown work you would have a judgment as soon as you read it whether it was literature or not. And so in every field the end of education is to bring one to the point where he can bring the highest judgment of the world to bear upon the thing which is before him.

That is what the University as a world institution stands for. That, according to the measure of our ability, is what we stand for. And that is the object of all the extension work of every sort that we shall undertake.

Mr. Brooks, the professor of art, is sending about over the State little boxes of pictures. Some of you have had them in your schools, no doubt. They do not make a great show. The boxes are rather small. The pictures are small; but there is no picture in any of those boxes that is not judged to be either itself a masterpiece, or a photograph of a masterpiece. Something like two-thirds of these pictures are original etchings and drawings by masters; and many of the children will for the first time in their lives see the work of a master at first hand.

These pictures, as I say, are small, but they are good. They are first rate; and the object of this exhibit is to help young people to the point where they can know a good thing when they see it.

So in every field. So in the field in which you are interested in this conference. Our object has been, last year and this year, to bring here the best men in the country, so that we may have the advantage of their ideas and their instruction and their inspiration.

One might say that the end of organized society is to bring the best that is anywhere to each point. The function of the University is to do that.

In the old days there was a feeling on the part of some persons that Indiana was a country far removed from the centers of civilization. The name Hoosier was a reproach. I remember myself twenty-five years ago going up and down the State saying with all my might that this is the holy land. I believed that then and I believe it now. I believe there is no place where the sun shines

brighter than it does here. I believe in the phrase that I remember from an old lecture, the first I ever gave, that the Wabash is as good a river and draws after it a retinue of brooks as beautiful as the Jordan or the Rhine. I believe that we, standing here upon this maligned ground of Hoosierdom, can receive the largest and best light that there is in the world, and make this in its turn a center of universal enlightenment.

APPENDIX

***During the conference on Educational Measurements the auditorium in which the meetings were held was provided with booths, in which were hung a large number of tables and charts dealing with problems considered in the conference. The following exhibits from among this material are selected for reproduction here.

A. BLOOMINGTON PUBLIC SCHOOLS

(Data furnished by Superintendent H. L. Smith)

EXHIBIT I.—SHOWING PERCENTAGE OF PROMOTIONS IN THE GRADE SCHOOLS AT THE CLOSE OF THE FIRST SEMESTER, 1914–15. (ALL CHILDREN IN THE SYSTEM INCLUDED)

In the following Tables promotions are worked out on four bases:

Basis No. 1. Percentage that number of promotions plus number of conditions is of number of pupils remaining until close of the semester.

Basis No. 2. Percentage that number of promotions plus number of conditions is of the number of pupils remaining to end of semester plus the number that withdrew during the semester to quit school.

Basis No. 3. Percentage the number of promotions is of the number of pupils remaining until close of the semester.

Basis No. 4. Percentage the number of promotions is of the number of pupils remaining to end of semester plus those who withdrew to quit school.

GRADE.	Promotions on Basis No. 1.	Promotions on Basis No. 2.	Promotions on Basis No. 3.	Promotions on Basis No. 4.
1B	82.5	80.2	79.0	76.7
1A	90.4	90.4	89.4	89.4
2B	95.3	95.3	93.6	93.6
2A	97.1	97.1	94.3	94.3
3B	89.6	89.6	84.3	84.3
3A	96.7	96.7	93.7	93.7
4B	88.9	88.9	76.8	76.8
4A	88.0	88.0	86.0	86.0
5B	93.8	91.9	86.2	85.7
5A	91.7	89.0	89.7	89.0
6B	88.3	85.0	68.9	66.3
6A	88.8	84.5	53.8	51.2
7B	90.4	85.2	53.0	50.0
7A	88.9	82.1	58.3	53.8
8B	84.3	80.5	65.1	62.1
8A	97.8	95.7	97.8	95.7
9B	88.2	76.7	87.0	75.6
9A	88.0	76.1	80.1	69.7
10B	96.1	87.0	89.8	81.2
10A	86.8	80.7	78.7	73.1
11B	94.2	90.6	86.4	83.1
11A	92.7	87.7	88.6	83.8
12B	98.0	92.3	95.4	90.0
12A	95.5	91.3	93.2	89.1

EXHIBIT II.—SHOWING PERCENTAGE OF PROMOTIONS BY SUBJECTS IN THE BLOOMINGTON HIGH SCHOOL, AT THE CLOSE OF THE FIRST SEMESTER, 1914–15

In the following Tables promotions are worked out on four bases:

Basis No. 1. Percentage that number of promotions plus number of conditions is of number of pupils remaining until close of the semester.

Basis No. 2. Percentage that number of promotions plus number of conditions is of the number of pupils remaining to end of semester plus the number that withdrew during the semester to quit school.

Basis No. 3. Percentage the number of promotions is of the number of pupils remaining until close of the semester.

Basis No. 4. Percentage the number of promotions is of the number of pupils remaining to end of semester plus those who withdrew to quit school.

GRADE.	Promotions on Basis No. 1.	Promotions on Basis No. 2.	Promotions on Basis No. 3.	Promotions on Basis No. 4.
English	90.7	82.2	84.3	76.4
Latin	91.5	87.8	88.0	84.5
German	86.7	79.6	84.7	77.8
Mathematics	87.5	79.6	80.6	73.3
History	92.2	85.2	86.3	79.7
Commercial	92.5	80.4	88.7	77.1
Physical Geography	94.1	84.2	94.1	84.2
Physics	100.0	95.5	98.4	94.0
Botany	86.4	76.0	77.3	68.0

EXHIBIT III.—SHOWING BY PERCENTS THE DISTRIBUTION OF SCHOLARSHIP MARKS GIVEN IN VARIOUS SUBJECTS AND GRADES, FIRST SEMESTER, 1914–15

Part 1.—Distribution by Subjects and Grades

SUBJECT AND GRADE.	Superior, 96-100.	Excellent, 91-95.	Good, 86-90.	Fair, 81-85.	Passing, 75-80.	Not Passing, Below 75.
READING:						
1B	10.8	16.7	24.3	24.3	11.7	12.2
1A	2.2	21.7	26.1	32.7	9.8	7.6
2B	5.7	23.6	35.7	22.8	7.9	4.3
2A	11.4	27.6	36.2	15.2	6.7	2.9
3B	3.9	24.5	31.6	16.8	19.4	3.9
3A	8.0	31.0	34.0	19.0	7.0	1.0
4B	10.9	21.2	29.9	24.1	10.9	2.9
4A	4.0	18.2	32.3	21.2	20.2	4.0
5B	2.4	22.4	33.6	28.8	12.0	0.8
5A	10.3	15.5	42.3	21.6	10.3	0.0
6B	0.9	15.3	29.7	27.0	24.3	2.7
6A	1.3	11.3	15.0	30.0	30.0	12.5
7B	3.5	17.6	18.8	16.5	34.1	9.4
7A	1.4	10.9	19.2	16.4	39.7	12.3
8B	0.0	12.5	25.0	29.2	18.1	15.3
8A	0.0	6.7	20.0	21.7	43.3	8.3
GEOGRAPHY:						
4B	2.5	13.8	46.3	31.3	6.3	0.0
4A	15.2	20.2	34.3	12.1	9.1	9.1
5B	3.2	11.1	32.5	23.8	23.8	5.6
5A	4.2	9.5	41.1	32.6	10.5	2.1
6B	0.0	9.0	24.3	20.7	34.2	11.7
6A	0.0	8.8	12.5	20.0	46.2	12.5
7B	0.0	5.9	18.8	22.4	44.7	8.3
7A	0.0	9.7	23.6	25.0	34.7	6.9
ARITHMETIC:						
3B	3.8	17.9	29.5	19.2	17.9	11.5
3A	9.2	22.0	29.4	22.9	12.8	3.7
4B	0.0	12.5	19.9	27.2	26.5	14.0
4A	10.1	18.1	31.3	13.1	18.1	9.1
5B	2.5	12.3	26.2	22.1	32.0	4.9
5A	4.1	11.3	32.0	22.7	19.6	10.3
6B	0.9	15.3	28.8	26.1	20.7	8.1
6A	0.0	7.5	22.5	28.8	26.2	15.0
7B	3.5	14.1	20.0	15.3	25.9	21.2
7A	1.4	17.0	22.2	25.0	34.7	9.7
8B	0.0	10.8	21.5	26.2	30.8	10.8
8A	0.0	4.9	6.6	31.1	50.8	6.6

EXHIBIT III—Continued

SUBJECT AND GRADE.	Superior, 96-100.	Excellent, 91-95.	Good, 86-90.	Fair, 81-85.	Passing, 75-80.	Not Passing, Below 75.
LANGUAGE AND GRAMMAR:						
4B	4.0	14.2	37.0	21.3	17.3	6.3
4A	5.1	21.5	36.7	17.3	15.3	4.0
5B	3.2	16.1	30.0	36.3	13.7	0.8
5A	3.1	14.4	35.1	30.9	12.4	4.1
6B	0.9	5.4	15.3	30.6	27.9	19.8
6A	2.5	6.3	15.0	18.8	40.0	17.5
7B	1.7	5.1	33.9	30.5	0.0	28.8
7A	5.6	13.9	11.1	22.2	18.1	29.2
8B	0.0	5.6	15.5	12.7	36.6	29.7
8A	0.0	3.3	23.3	23.3	30.0	20.0
HISTORY:						
4B	2.5	9.0	36.0	38.5	13.9	0.0
4A	8.1	21.6	41.9	10.8	13.5	4.1
5B	3.1	11.8	32.3	41.7	10.2	0.8
5A	4.1	18.6	42.3	20.6	10.3	4.1
6B	10.0	8.2	22.5	15.3	28.8	15.3
6A	5.0	8.8	15.0	22.5	27.5	21.2
7B	0.0	0.0	7.7	33.0	51.6	7.7
7A	0.0	4.2	15.3	15.3	52.8	12.5
8B	0.0	0.0	18.3	26.8	35.2	19.7
8A	0.0	0.0	15.0	35.0	41.7	8.3
SPELLING:						
3B	8.4	33.7	32.5	9.0	7.2	9.0
3A	18.0	37.8	24.3	14.4	2.7	2.7
4B	11.7	32.1	26.3	19.7	7.3	2.9
4A	11.1	32.3	37.4	8.1	8.1	3.0
5B	7.9	29.8	35.1	21.1	4.4	1.8
5A	13.4	22.7	29.9	21.6	10.3	2.1
6B	39.0	32.7	15.9	6.2	6.2	0.0
6A	43.8	23.8	18.8	7.5	2.5	3.8
7B	58.8	21.2	9.4	2.4	7.1	1.2
7A	44.4	27.8	16.7	7.0	2.8	1.4
8B	49.3	26.0	11.0	6.8	4.1	2.7
8A	72.1	23.1	3.3	3.3	0.0	0.0

EXHIBIT III—Continued

SUBJECT AND GRADE.	Superior, 96-100.	Excellent, 91-95.	Good, 86-90.	Fair, 81-85.	Passing, 75-80.	Not Passing, Below 75.
LATIN (HIGH SCHOOL):						
9B	25.8	22.6	16.1	25.8	6.4	3.2
9A	0.0	15.4	23.1	30.8	15.4	15.4
10B	12.9	19.4	29.0	12.9	6.5	19.4
10A	10.0	15.0	15.0	25.0	5.0	30.0
11B	6.3	12.5	37.5	18.8	18.8	6.3
11A	7.7	38.5	30.8	15.4	7.7	0.0
12B	10.0	50.0	30.0	10.0	0.0	0.0
12A	28.6	42.9	14.3	14.3	0.0	0.0
GERMAN (HIGH SCHOOL):						
9B	0.0	32.0	14.0	18.0	22.0	14.0
9A	0.0	6.3	18.7	25.0	18.7	31.3
10B	0.0	9.0	24.4	17.8	31.1	17.8
10A	3.3	6.7	16.7	20.0	26.7	26.7
11B	6.8	17.2	24.1	38.0	10.3	3.4
11A	0.0	18.2	36.4	18.2	18.2	9.0
12B	0.0	30.8	38.5	7.7	23.1	0.0
12A	0.0	16.7	16.7	16.7	33.3	16.7
ENGLISH (HIGH SCHOOL):						
9B	0.0	13.6	25.8	31.8	18.2	10.6
9A	2.9	17.1	20.0	34.3	8.6	17.1
10B	1.9	11.3	35.8	13.2	20.8	17.0
10A	0.0	5.1	7.7	25.6	41.0	20.5
11B	0.0	10.9	13.0	26.1	45.7	4.3
11A	0.0	4.5	0.0	22.7	45.5	27.2
12B	0.0	11.3	30.2	22.7	30.2	5.7
12A	0.0	9.0	45.5	27.3	18.2	0.0
HISTORY (HIGH SCHOOL):						
10B	0.0	20.4	22.4	28.6	16.3	12.2
10A	.....	.....	.....	.....	.....	.....
11B	4.1	12.2	28.5	20.4	24.5	10.2
11A	0.0	13.3	26.7	33.3	26.7	0.0
12B	7.0	9.3	53.5	16.3	9.3	4.7
12A	5.9	23.5	29.4	29.4	5.9	5.9

EXHIBIT III—Continued

SUBJECT AND GRADE.	Superior, 96-100.	Excellent, 91-95.	Good, 86-90.	Fair, 81-85.	Passing, 75-80.	Not Passing, Below 75.
MATHEMATICS (HIGH SCHOOL):						
9B	9.4	20.3	29.7	14.1	10.9	15.6
9A	8.0	28.0	28.0	12.0	4.0	20.0
10B	0.0	15.3	22.0	23.7	25.4	13.6
10A	5.0	10.0	17.5	20.0	25.0	22.5
11B	0.0	8.7	21.7	23.9	32.6	13.0
11A	11.1	7.4	11.1	33.3	29.7	7.4
COMMERCIAL (HIGH SCHOOL):						
9B	0.0	29.4	17.6	29.4	11.8	11.8
9A	0.0	7.7	15.4	23.1	53.8	0.0
10B	4.3	39.1	13.0	21.7	4.3	17.4
10A	0.0	20.0	0.0	50.0	30.0	0.0
11B	0.0	16.1	29.0	29.0	19.4	6.5
11A	0.0	9.0	9.0	27.3	36.4	18.2
12B	5.9	11.8	17.7	29.4	35.3	0.0
12A	0.0	16.7	66.7	16.7	0.0	0.0
PHYSICAL GEOGRAPHY (HIGH SCHOOL):						
9A	17.7	23.5	47.1	5.9	0.0	5.9
PHYSICS (HIGH SCHOOL):						
12B	9.1	30.9	40.0	16.4	3.6	0.0
12A	0.0	0.0	100.0	0.0	0.0	0.0
BOTANY (HIGH SCHOOL):						
9B and 9A	0.0	9.5	19.0	33.3	19.0	19.0

EXHIBIT III—Continued

Part 2.—Distribution by Grades and by Subjects Combined

This table gives the percentage of "Superior", "Excellent", "Good", etc., awarded in all subjects included in Part 1.

GRADE.	Superior, 96–100.	Excellent, 91–95.	Good, 86–90.	Fair, 81–85.	Passing, 75–80.	Not Passing, Below 75.
ELEMENTARY SCHOOLS BY GRADES:						
1B	10.8	16.7	24.3	24.3	11.7	12.1
1A	2.2	21.7	26.1	32.6	9.8	7.6
2B	5.7	23.8	35.7	22.9	7.9	4.2
2A	11.4	27.6	36.2	15.2	6.7	2.8
3B	5.5	25.6	31.2	14.9	14.7	8.2
3A	11.9	30.3	29.1	18.7	7.5	2.5
4B	5.5	17.6	31.4	26.5	14.2	4.8
4A	8.6	21.5	35.4	14.6	14.6	5.4
5B	3.5	17.8	31.1	29.1	16.1	2.4
5A	6.4	15.1	36.4	24.6	12.0	5.4
DEPARTMENT SCHOOL BY GRADES:						
6B	8.4	14.4	22.8	21.0	23.7	9.6
6A	8.8	11.0	16.5	21.3	28.7	13.7
7B	11.6	10.8	16.5	19.8	28.9	12.2
7A	8.8	12.2	18.1	18.5	30.5	12.0
8B	10.2	10.0	15.8	21.2	28.0	14.7
8A	14.6	7.3	13.6	22.8	33.1	8.6
HIGH SCHOOL BY GRADES:						
9B	5.7	22.0	22.9	23.3	13.9	12.2
9A	5.1	15.3	23.7	22.9	16.1	17.0
10B	2.3	16.7	25.8	20.2	19.4	15.6
10A	3.5	9.2	12.8	24.8	27.7	22.0
11B	2.3	12.4	24.0	25.8	27.6	7.8
11A	3.9	11.8	15.7	25.5	32.3	10.8
12B	5.2	20.3	37.5	18.2	16.1	2.6
12A	5.8	19.2	40.4	21.2	9.6	3.8

EXHIBIT III—Continued

Part 3.—Subject Averages, All Grades

SUBJECT.	Superior, 96–100.	Excellent, 91–95.	Good, 85–90.	Fair, 81–85.	Passing, 75–80.	Not Passing, Below 75.
DEPARTMENT SCHOOL:						
Reading	1.3	13.4	21.8	21.6	32.0	9.9
Geography	0.0	8.7	17.6	22.3	41.1	10.4
Arithmetic	1.1	10.7	20.1	25.5	30.3	12.3
History	3.2	4.1	14.1	23.3	40.5	14.8
Grammar	1.8	6.9	18.2	21.4	27.1	24.6
German	0.0	0.0	28.6	28.6	21.4	21.4
Latin	0.0	8.3	33.3	25.0	33.3	0.0
Spelling	51.7	24.0	13.1	5.4	4.3	1.5
HIGH SCHOOL:						
English	.6	11.1	22.5	25.2	28.0	12.6
Mathematics	4.9	14.7	22.3	20.4	22.6	15.0
Physical Geography	16.7	22.2	44.4	5.6	0.0	11.1
History	3.4	15.4	32.6	24.6	16.0	8.0
Latin	13.5	23.4	24.1	20.0	7.8	11.3
German	1.5	17.5	21.5	21.0	23.0	15.5
Commercial	1.6	20.3	19.5	28.1	22.7	7.8
Physics	8.3	28.3	45.0	15.0	3.3	0.0
Botany	0.0	10.5	21.1	36.8	21.1	10.5
DEPARTMENT SCHOOL AS A WHOLE	10.1	11.4	17.9	20.7	28.2	11.7
HIGH SCHOOL AS A WHOLE	4.0	16.3	24.6	22.4	20.8	11.8

EXHIBIT IV.—ACHIEVEMENT OF BLOOMINGTON HIGH SCHOOL GRADUATES AS STUDENTS IN INDIANA UNIVERSITY

Showing for all undergraduates in Indiana University and for all undergraduates of Indiana University who were alumni of the Bloomington high school, the number and percent of hours of work of the various qualities—A (100–95), B (94–85), C (84–75), D (74–65), E (Conditioned, Failed, and Incomplete)—for the school year 1910–11.

	Work Marked A.		Work Marked B.		Work Marked C.	
	Total Number of Hours.	Percent of Total Number of Hours of Work Taken.	Total Number of Hours.	Percent of Total Number of Hours of Work Taken.	Total Number of Hours.	Percent of Total Number of Hours of Work Taken.
Total Indiana University undergraduates for year 1910-11.....	.....	21.7	.....	35.8	.....	24.3
Indiana University undergraduates who were alumni of Bloomington high school...	619	23.0	995	37.0	701	26.0

	Work Marked D.		Work Conditioned, Failed, or Incomplete.	
	Total Number of Hours.	Percent of Total Number of Hours of Work Taken.	Total Number of Hours.	Percent of Total Number of Hours of Work Taken.
Total Indiana University undergraduates for year 1910–11	.....	9.8	.....	8.3
Indiana University undergraduates who were alumni of Bloomington high school ...	252	9.4	124	4.6

The following table indicates the showing made by Bloomington high school graduates in the award of honors at Indiana University:

School year ending	Total Graduates			Graduating with High Distinction		
	Total Indiana University graduates.	Total Indiana University graduates also Bloomington high school graduates	Percent of total number Bloomington high school graduates	Number Indiana University graduating with high distinction	Number Bloomington high school graduating with high distinction	Percent of high distinction Bloomington high school graduates supply
1909.....	205	18	8.8	3	0	0
1910.....	215	11	5.1	5	1	20
1911.....	202	17	8.4	5	1	20
1912.....	225	12	5.3	6	2	33.3
1913.....	265	20	7.5	12	1	8.3
Total...	1112	78	7.1	31	5	16.1

School year ending	Graduating with Distinction			Both Honors		
	Number Indiana University graduating with distinction	Number Bloomington high school graduating with distinction	Percent of distinction Bloomington high school graduates supply	Number Indiana University graduates in both classes of distinction	Number Bloomington high school graduates in both classes of distinction	Percent of both classes of distinction supplied by Bloomington high school graduates
1909.....	9	1	11.1	12	1	8.3
1910.....	8	0	0.0	13	1	7.7
1911.....	17	4	23.5	22	5	22.7
1912.....	16	5	31.3	22	7	31.8
1913.....	18	4	22.2	30	5	16.7
Total...	68	14	20.6	99	19	19.2

Exhibit V.—Showing Number and Percent of Pupils Entering the Bloomington High School who Completed their High School Course

Class entering	Number in class	Number graduated from Bloomington high school	Number graduated from high school elsewhere	Percent of entering class that graduated
January, 1904	22	15	3	81.8
January, 1905	36	15	1	44.4
January, 1906	22	10	2	54.5
January, 1907	37	17	3	54.1
January, 1908	30	14	1	50.0
January, 1909	25	12	2	56.0
Total	172	83	12	55.8
September, 1905	96	47	2	51.0
September, 1906	63	33	2	55.6
September, 1907	73	43	2	61.6
September, 1908	55	10	5	27.3
September, 1909	105	49	1	47.6
Total	392	182	12	49.5
Grand total, January and September	564	265	24	51.2

EXHIBIT VI.—TABLE SHOWING WITHDRAWALS FROM HIGH SCHOOL BY SEX AND NUMBER OF CREDITS AT TIME OF WITHDRAWAL

The number of credits required to graduate is 32. The period covered began with the second semester, 1903-04, and closed with the second semester, 1914.

NUMBER OF CREDITS AT TIME OF WITHDRAWAL	Boys	Girls	Total	Percent of total withdrawals
0	1	4	5	1.0
1	14	4	18	3.6
2	10	12	22	4.5
3	19	12	31	6.3
4	27	28	55	11.1
5	12	13	25	5.1
6	9	16	25	5.1
7	14	16	30	6.1
8	17	29	46	9.3
9	6	14	20	4.0
10	5	11	16	3.2
11	7	9	16	3.2
12	8	12	20	4.0
13	5	8	13	2.6
14	9	10	19	3.8
15	6	10	16	3.2
16	10	11	21	4.2
17	9	4	13	2.6
18	1	8	9	1.8
19	5	6	11	2.2
20	1	6	7	1.4
21	4	3	7	1.4
22	7	6	13	2.6
23	0	2	2	.4
24	5	6	11	2.2
25	2	1	3	.6
26	1	2	3	.6
27	2	3	5	1.0
28	4	0	4	.8
29	0	2	2	.4
30	2	3	5	1.0
31	1	0	1	.2
Total	223	271	494	99.5

EXHIBIT VII.—WITHDRAWALS BY SEMESTERS. ALL WITHDRAWALS FOR ANY CAUSE WHATEVER

YEAR	Semester	Withdrawals in semester	Withdrawals in year
1903–1904	First	3	
	Second	9	12
1904–1905	First	10	
	Second	23	33
1905–1906	First	12	
	Second	37	49
1906–1907	First	10	
	Second	28	38
1907–1908	First	17	
	Second	17	34
1908–1909	First	18	
	Second	29	47
1909–1910	First	22	
	Second	34	56
1910–1911	First	18	
	Second	29	47
1911–1912	First	15	
	Second	42	57
1912–1913	First	23	
	Second	36	59
1913–1914	First	12	
	Second	39	51

EXHIBIT VIII.—NUMBER AND PERCENT OF EIGHTH GRADE GRADUATES FROM THE BLOOMINGTON COMMON SCHOOLS THAT ENTER THE BLOOMINGTON HIGH SCHOOL

DATE OF GRADUATION FROM GRADES	Number in class	Number entering high school	Percent entering high school
January, 1907	36	32	88.9
May, 1907	29	25	86.2
January, 1908	34	31	91.2
May, 1908	39	34	87.2
January, 1909	31	28	90.3
May, 1909	46	42	91.3
January, 1910	25	20	80.0
June, 1910	17	16	94.1
January, 1911	31	29	93.5
June, 1911	62	58	93.5
January, 1912	36	35	97.2
June, 1912	55	48	87.3
January, 1913	39	36	92.3
June, 1913	51	41	80.4
January, 1914	30	26	86.7
Total	561	501	89.3

Exhibit IX.—Withdrawals from High School According to Age Since the Year 1904–05

In many cases age records were not available.

Age at time of withdrawal	Boys	Girls	Total
14	3	6	9
15	18	15	33
16	25	28	53
17	44	48	92
18	25	27	52
19	16	27	43
20	11	13	24
21	1	1	2
22	4	1	5
23	1	1	2
24	1	0	1
Total	149	167	316

EXHIBIT X.—PRESENT OCCUPATION OF 409 GRADUATES OF BLOOMINGTON HIGH SCHOOL

Table worked out by Mr. Fred Lewis, formerly teacher of mathematics in Bloomington High School.

PRESENT OCCUPATION	Class 1903			Class 1904			Class 1905			Class 1906			Class 1907			Class 1908			Class 1909			Class 1910			Class 1911			Class 1912			Total		
	Boys	Girls	Both	Boys	Girls	Both	Boys	Girls	Both	Boys	Girls	Both	Boys	Girls	Both	Boys	Girls	Both	Boys	Girls	Both	Boys	Girls	Both	Boys	Girls	Both	Boys	Girls	Both	Boys	Girls	Both
Teacher	3	3	6	5	8	13	0	6	6	2	3	5	2	6	8	3	8	11	3	12	15	0	3	3	0	9	9	2	8	10	20	66	86
Student	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	4	9	3	12	8	10	18	13	10	23	7	10	17	39	35	74
Clerk	0	1	1	1	1	2	0	1	1	1	1	2	0	1	1	2	2	4	2	1	3	2	3	5	0	0	0	0	0	0	8	11	19
Bookkeeper	0	0	0	1	0	1	0	2	2	0	0	0	0	3	3	1	0	1	0	0	0	0	3	3	1	2	3	1	1	2	4	11	15
Stenographer, typewriter, and clerical work	0	0	0	0	1	1	0	0	0	0	2	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	2	1	5	6
Reporter, author, literary work, and miscellaneous	1	0	1	2	1	3	0	1	1	1	0	1	1	0	1	0	1	1	3	0	3	0	0	0	1	0	1	0	0	0	9	3	12
Music teacher and musician	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	1	0	0	0	0	1	1	2	3	5
No occupation or occupation unknown	0	1	1	3	0	3	2	0	2	3	0	3	4	0	4	3	4	7	5	3	8	3	3	6	2	2	4	2	0	2	27	13	40
Deceased	1	0	1	0	1	1	0	1	1	0	2	2	0	0	0	1	1	2	1	0	1	0	0	0	2	0	2	0	0	0	5	5	10
Farmer	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	6	0	6
Laborer	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	4	0	4
Traveling salesman	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	0	2	0	0	0	0	0	0	0	0	0	5	0	5
Physician, lawyer	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	6	0	6
Merchant, business	1	0	1	1	0	1	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4
Engineers, etc	0	0	0	1	0	1	1	0	1	1	0	1	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	5	0	5
Housewife	0	14	14	0	9	9	0	13	13	0	11	11	0	7	7	0	9	9	0	10	10	0	5	5	0	3	3	0	0	0	0	81	81
Girls at home	0	5	5	0	5	5	0	3	3	0	4	4	0	8	8	0	0	0	0	4	4	0	1	1	0	0	0	0	1	1	0	31	31
Total	10	24	34	16	27	43	4	27	31	10	23	33	10	25	35	15	28	43	30	33	63	15	29	44	21	26	47	14	22	36	145	264	409

B. KENDALLVILLE PUBLIC SCHOOLS

(Data furnished by Superintendent P. C. Emmons)

EXHIBIT I.—EXPERIMENT IN THE USE OF THE HILLEGAS SCALE FOR ENGLISH COMPOSITION IN GRADE 8B

The subject assigned was: "How I would spend one hundred dollars to please five persons who like different things." Thirty-nine themes were graded by three judges, independently of each other. The grading was done rapidly. All three judges agreed exactly in two cases. Two judges agreed exactly in twenty-one other cases. Two judges agreed within fifty points of each other in all but eight cases.

	Judges			Value Selected
	E	B	S	
Leola DeVoe	675	474	585	585
Jesse Shipe	675	725	675	675
Milo Miller	472	369	369	369
Rilla Throp	725	585	700	700
Edward Geauque	700	625	772	700
Vogal King	675	675	772	675
Ruth Barnett	585	650	500	585
Helen Ortstadt	474	675	772	675
Howard Riddle	400	260	369	369
Clarence Milleman	369	369	450	369
Ralph Atz	369	369	750	369
Gladys Schnapp	325	474	400	400
Merlyn Staples	500	675	700	675
Harold Sebert	400	369	400	400
Mildred Carrick	675	625	675	675
Sheldon Eminger	260	369	369	369
Victor Burger	675	474	450	474
Florence Reichard	585	474	600	585
Lillian Gindlesparger	400	474	400	400
Trevor Shore	260	260	400	260
Lestie Martin	585	585	772	585
Marjorie Hess	260	369	585	369
Anna Miller	675	575	772	585
Helen Childs	369	369	369	369
Robert France	400	400	474	400
Geneva Davidson	675	474	550	550
Catherine Canode	700	675	772	700
Nellie Davis	585	585	750	585
Ruth Herb	369	369	585	369

EXHIBIT I.—Continued

	Judges			Value Selected
	E	B	S	
Lucile Johnson	369	474	400	400
Ruah Henry	474	474	585	472
Leland Miller	474	369	474	474
Glen Henry	369	369	450	369
Verus Smith	350	369	585	369
Helen Grams	675	675	675	675
Clinton Cunningham	700	474	474	474
Merle Morr	260	260	369	260
Paul Bruck	260	260	400	260
Bessie Oviatt	474	474	772	272
Lower Quartile	369	369	400	369
Median	474	474	585	474
Upper Quartile	675	610	675	675

EXHIBIT II.—EXPERIMENT IN THE USE OF THE HILLEGAS SCALE FOR ENGLISH COMPOSITION IN GRADE 8A

The subject assigned in this test was the same as in Exhibit I, and the grading was on the same basis. Wherever the values assigned by one judge differed greatly from those of the other two, a second reading was asked for, after an interval long enough to insure an independent second grading.

	Judges			Value Selected
	E	B	S	
Howard Foehl	675	600	772	675
Duane Jackson	474	369	369	369
Paul Bell	550	369	474	474
Walter Reed	474	369	550	474
Geo. Koons	675	585	675	675
Olive Rex	725	675	675	675
Ray Swogger	665	606	675	665
Benj. Moses	665	675	675	675
Robt. Shade	500	500	474	500

EXHIBIT II.—Continued

	Judges			Value Selected
	E	B	S	
Violet Crofoot	585	585	675	585
Vera Hendricks	675	650	675	675
Una Persing	585	625	665	625
Clara Milleman	675	675	675	675
Lloyd Uhl	585	550	575	575
Harrison Miller	675	665	665	665
Clarence Woolf	665	665	665	665
Sidney Munton	725	772	700	725
Iona Hosler	665	650	675	665
Sylvester Adams	665	772	772	772
Dolores Ryan	550	665	575	575
Miriam Diggins	750	772	772	772
Dallas Broughton	650	675	675	675
Walter Kaiser	500	550	575	550
Vogal Miller	650	600	675	650
Bernadine Kling	625	600	675	625
Ruth McFarland	500	550	550	550
Orville Diggins	550	550	550	550
Agnes Sobraski	600	675	665	665
Georgia Rowland	550	575	600	575
Harry Franke	550	665	665	665
Marie Dickinson	425	450	400	425
Totals	18,803	17,678	18,458	19,086

Total of all judges' marks	54,939
Total number of judgments	93
Average grade for class	590
Total values selected	19,086
Average of selected value for class	615
Median of total number of judgments	665
Lower Quartile	550
Upper Quartile	675

EXHIBIT III.—SEVEN COMPOSITIONS WRITTEN BY PUPILS IN HORACE MANN SCHOOL (TEACHERS' COLLEGE), AND GRADED ON THE HILLEGAS SCALE BY A CLASS OF TEACHERS, IN THE SUMMER SESSION, AND AGAIN BY THIRTY KENDALLVILLE TEACHERS

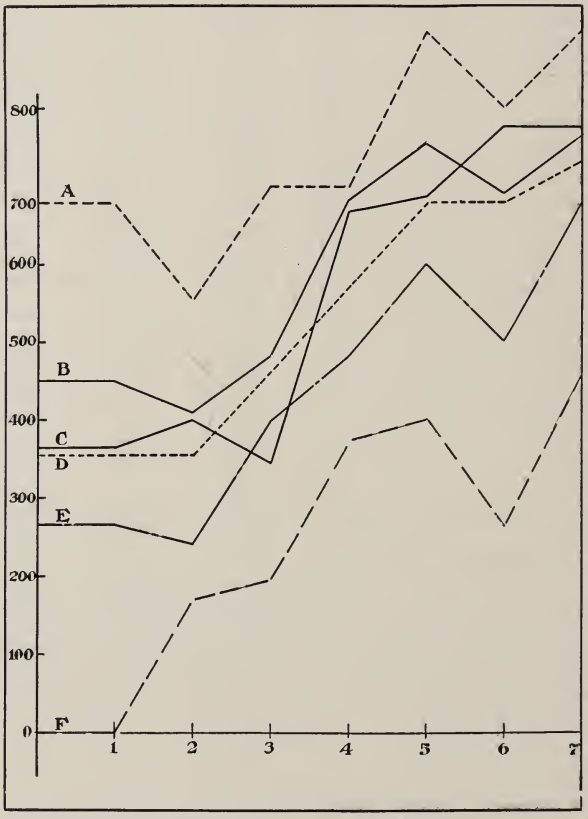

Fig. 51

A and F = Highest and lowest scaling for each composition.
B and E = Limits within which 50 percent of grades fell.
D = Median reading, Teachers' College.
C = Median, Kendallville.

EXHIBIT IV.—COMPARISON OF THE RATINGS OF SEVEN ENGLISH COMPOSITIONS ON THE HILLEGAS SCALE BY THREE HIGH SCHOOL TEACHERS OF ENGLISH AND TWO DEPARTMENT TEACHERS OF ENGLISH

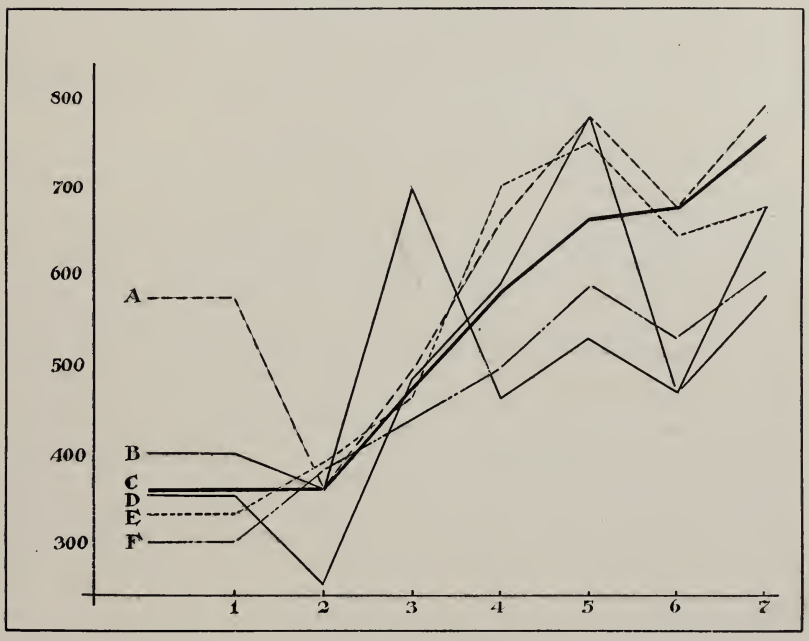

Fig. 52

A, B, D = High School English Teachers.
C = Median of twenty-nine readings.
E, F = Department English Teachers.
1, 2, 3, 4, etc. = Compositions.

C. LAPORTE PUBLIC SCHOOLS

(Data furnished by Superintendent Arthur Deamer)

EXHIBIT I.—EXPERIMENT IN THE USE OF THE HILLEGAS SCALE FOR ENGLISH COMPOSITION IN GRADES 4, 5, 6, 7, AND 8

The children of the fourth, fifth, sixth, seventh, and eighth grades were asked to write compositions on the subject, "How to spend one hundred dollars to please five different persons who like different things." This subject was written on the board and the children were allowed a few minutes to ask questions. They were told to treat the subject any way they wished, just so they made an interesting story about it. They were then allowed twenty-two minutes in which to write.

The papers were then collected and after each was given a code mark to indicate the school grade and teacher of the writer, the papers were shuffled and then graded by a committee of twelve teachers, by the use of the Hillegas scale. This scale was prepared by Dr. Hillegas of Columbia University and contains ten sample compositions rated as follows: 0, 1.83, 2.60, 3.69, 4.74, 5.95, 6.75, 7.72, 8.38, and 9.37. Thus a perfect paper would be marked 9.37, and an incoherent and meaningless one was marked 0. However, for the sake of convenience the decimal was dropped and the scores were marked from 0 to 10. Two teachers' meetings were held to discuss the Hillegas scale and to get the ten samples clearly in mind. Then each teacher was instructed to grade according to her judgment, bearing in mind that the fundamental thing was to discover which one of the ten Hillegas samples the composition under consideration most nearly resembled as far as quality was concerned and to give to that composition the mark that the Hillegas sample bore. After all the papers were thus examined and marked by the committee, three other examiners made a random choice of a number of papers and examined these with the idea of getting some idea of the gradings. In the main the second committee agreed with the first. Some of the papers were grader higher and some lower, and many were given the same rating. The conclusion was that there was not enough difference to vitiate the results since the median scores were to be used.

The children of the same grades in Butte, Mont., were asked to write compositions on the same subject under the same conditions. The papers were also scored by a committee of teachers of that city and the results are attached for the sake of comparison. These data were taken from the Butte survey. Certain fifth-grade classes in Maryland have averaged 5.15, also certain seventh-grade classes in Maryland and New York have been found to average from 5.75 to 7. It is to be regretted that these results were not secured for the entire cities so that they might be used as a basis for detailed comparison.

The following table shows the distribution of the scores by grades, also medians for Laporte and Butte:

GRADE	0	1	2	3	4	5	6	7	8	9	Total	Medians	
												Laporte	Butte
Fourth	1	10	22	29	36	22	6	2	0	1	129	4.1	2.3
Fifth	...	10	30	31	24	27	17	15	1	...	155	4.4	2.9
Sixth	1	10	16	15	19	20	14	15	11	1	122	5.0	3.4
Seventh	2	4	7	9	21	20	15	17	17	2	114	5.8	3.7
Eighth	...	1	3	7	5	5	11	11	11	5	59	6.8	4.1
Total	4	35	78	91	105	94	63	60	40	9	579	4.8	3.3

Since no definite standards of achievements have been made we do not know definitely whether we are high, average, or low in our ability to write. Certain of our fourth-grade classes went to 4.6, one of our fifth grades made 4.7, one of the sixth grades went to 5.9, one of the seventh grades to 6.3, and the median for the eighth grade was 7.7. The median score for the city was 4.8.

The rate of improvement is gradual as shown by the increasing value of the medians. Considerable individuality was shown thruout by the children in the compositions. There was very little similarity of content among them in the same school, thus indicating that no definite suggestions were made by the teachers as to what should be written. The spelling, punctuation, and paragraphing showed that these phases of the work were not neglected in our schools.

EXHIBIT II.—THE STONE TEST IN ARITHMETICAL PROBLEMS INVOLVING REASONING

The Stone test in arithmetical problems involving reasoning was given two weeks after the beginning of the second semester. The following is the list of problems:

1. If you buy 2 tablets at 7 cents each and a book for 65 cents, how much change should you receive from a two-dollar bill?

2. John sold 4 *Saturday Evening Posts* at 5 cents each. He kept ½ the money and with the other ½ he bought Sunday papers at 2 cents each. How many did he buy?

3. If James had 4 times as much money as George, he would have $16. How much has George?

4. How many pencils can you buy for 50 cents at the rate of 2 for 5 cents?

5. The uniforms for a baseball nine cost $2.50 each. The shoes cost $2 a pair. What was the total cost of uniforms and shoes for the nine?

6. In the schools of a certain city there are 2,200 pupils; ½ are in the primary grades, ¼ in the grammar grades, ⅛ in the high school, and the rest in the night school. How many pupils are there in the night school?

7. If 3½ tons of coal cost $21, what will 5½ tons cost?

8. A news dealer bought some magazines for $1. He sold them for $1.20, gaining 5 cents on each magazine. How many magazines were there?

9. A girl spent ⅛ of her money for car fare, and three times as much for clothes. Half of what she had left was 80 cents. How much money did she have at first?

10. Two girls receive $2.10 for making button-holes. One makes 42, the other 28. How shall they divide the money?

11. Mr. Brown paid one-third of the cost of a building; Mr. Johnson paid ½ the cost. Mr. Johnson received $500 more annual rent than Mr. Brown. How much did each receive?

12. A freight train left Albany for New York at 6 o'clock. An express left on the same track at 8 o'clock. It went at the rate of 40 miles an hour. At what time of day will it overtake the freight train if the freight train stops after it has gone 56 miles?

In scoring the problems the following values were used: Problems 1 2, 3, 4, and 5 were given a value of 1 point each; problem 6 was valued at 1.4; problem 7 at 1.2; problem 8 at 1.6; problems 9, 10, 11, and 12 at 2 points each. Thus a perfect paper scored 17 points. The decimals were dropped on the final markings of the papers. Thus a paper scoring 7.2 was marked 7 and a paper scored at 7.6, for example, was marked 8. This practice was followed in Butte and other cities where the Stone test has been given. If the answer was wrong no credit was given. The children were given 15 minutes to solve as many problems as possible. Two persons did all the scoring.

The following table shows the distribution of the scores with medians for the different grades. The medians given in the Butte Survey are included:

GRADE	0	1	2	3	4	5	6	7	8	9	10	11
Fifth	19	12	31	41	25	14	7	3	1	....	....	....
Sixth	8	8	14	17	31	22	11	9	2	3	1	1
Seventh	1	1	3	6	9	17	13	8	28	14	7	7
Eighth	....	....	....	1	2	12	5	7	9	2	6	5
Totals	28	21	48	65	67	65	36	27	40	19	14	13

GRADE	12	13	14	15	16	17	Total	Median	
								Laporte	Butte
Fifth	....	....	....	....	....	....	153	3.4	2.2
Sixth	....	....	....	....	....	....	127	4.6	3.9
Seventh	6	....	1	....	....	....	121	8.1	5.8
Eighth	4	6	....	2	....	1	62	8.6	7.7
Totals	10	6	1	2	....	1	463	5.1	4.8

The median scores are considerably better than those of Butte, Mont. It is to be regretted that more cities have not applied this standard test. It is true that a number of cities have done so, but in such a way as not to make results comparable since they have given credit for right reasoning when the answers were wrong. Twelve percent of Laporte's fifth grade, 6 percent of the sixth grade, and 1 percent of the seventh grade failed to solve a problem correctly. Six percent of all the children failed to solve a single example.

The following table shows the percents of the total enrollment of the children of Laporte and Butte who solved the different number of examples correctly:

EXAMPLES	0	1	2	3	4	5	6	7	8	9	10	11	12
Butte	7	10	10	12	13	11	10	7	7	3	3	2	2
Laporte	6	5	10	14	14	14	8	6	9	5	3	3	2

In Butte 20 percent of all the fifth-grade children failed to solve a single problem correctly and 4 percent of the sixth grade. The distribution of scores in Laporte was better than in Butte as is shown by the above percentile table. Twenty-five percent of the children made a score of 3 or less, 50 percent made scores ranging from 3 to 7, and 25 percent made scores of 7 or better.

D. MUNCIE PUBLIC SCHOOLS

(Data furnished by Principal Fred D. Lewis)

EXHIBIT I.—ONE HUNDRED THOUSAND COMPOSITIONS SCORED ACCORDING TO THE HILLEGAS COMPOSITION SCALE

During the school year 1914–1915 each child in the city schools above the 2B grade wrote one composition each week for a period of twenty-four weeks. The approximate number of compositions thus written was 100,000. These compositions were all scored by the Hillegas Composition Scale. The weekly scores for each grade in each building were averaged. After the work was completed, averages were made for each grade for the entire city. These averages are shown in graphic form below.

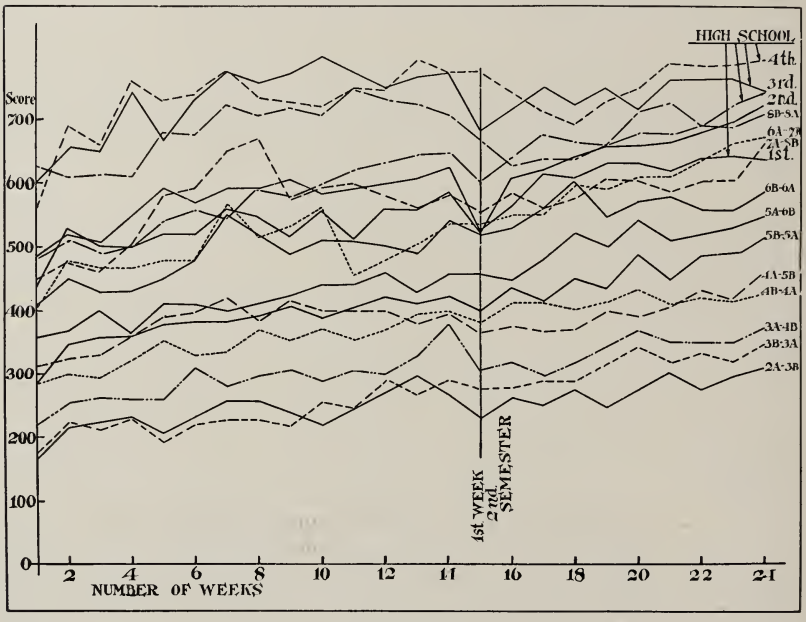

Fig. 53

Twenty-four weeks of practice in English composition in Muncie public schools, 1914-1915. Ordinates: score as represented on Hillegas scale. Abscissas: weeks of practice. Each curve represents score of one class thru the twenty-four weeks.

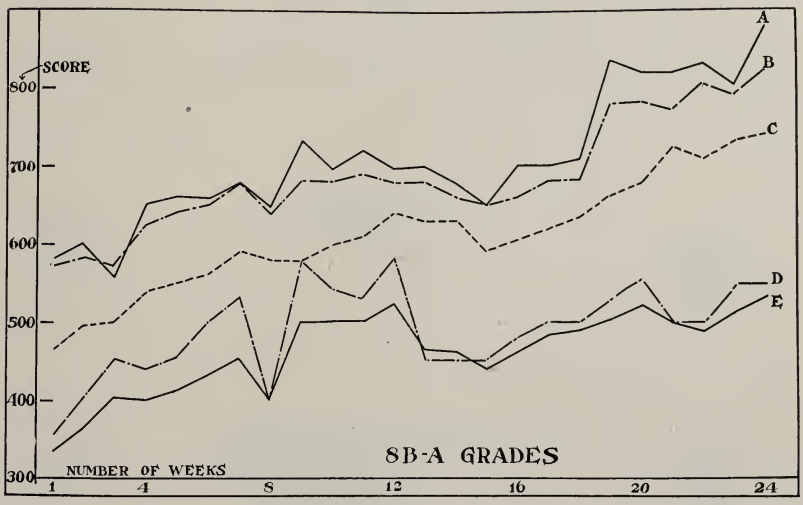

Fig. 54

Weekly practice in composition. Twenty-four weeks. Grade 8. Ordinates: score as represented on scale. Abscissas: weeks of practice.

A = Weekly score of best pupil, graded by Hillegas scale.
B = Same, graded by Harvard-Newton scale.
C = Average weekly score of class, graded by Hillegas scale.
D = Weekly score of poorest pupil, graded by Hillegas scale.
E = Same, graded by Harvard-Newton scale.

E. SOUTH BEND PUBLIC SCHOOLS

(Data furnished by Superintendent L. J. Montgomery, Assistant Superintendent M. W. Willing, and Principal H. G. Imel)

EXHIBIT I.—EXPERIMENT IN TEACHING SPELLING IN THE HENRY STUDEBAKER SCHOOL

This study in spelling was made to learn whether or not there was an actual growth in the ability of children to spell the commoner words that form the basis of the written composition of everyone.

Two tests were given, the first about February 1; the second about March 25. The results of the first are shown on Fig. 55. The results of the second on Fig. 56.

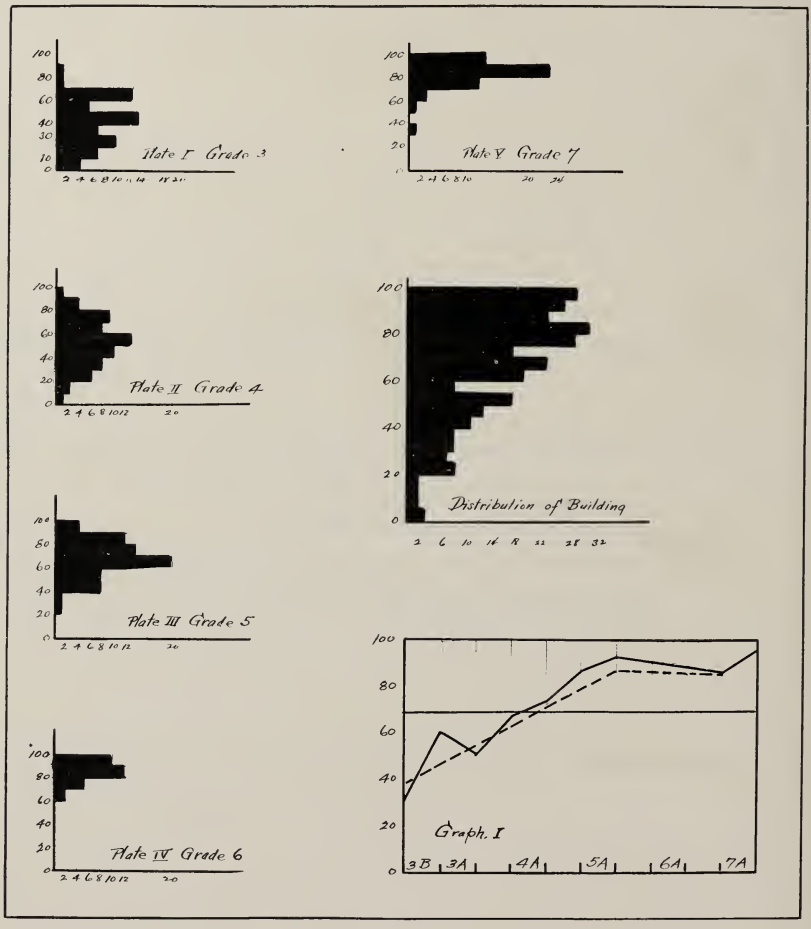

Fig. 55

For the test one hundred words were chosen at random from the second-grade list of the "North Dakota Spelling List" by Dr. Franklin Jones. Without previous warning or study these words were pronounced to the children and spelled by them (written spelling), twenty-five words daily. The incorrectly spelled words were checked on the papers daily. The daily list was then placed on the board and from that each pupil made a list of his misspelled words and was supposed to study these until they were mastered.

This method was expected to eliminate the useless droning over known words.

The total number of misspelled words was placed at the head of each list and the results tabulated, distributed, and medians found for each grade and half-grade.

Fig. 55 shows the results of this test in two ways: Graph 1. Ordinates show percents and abscissas show grades. The solid line shows medians by

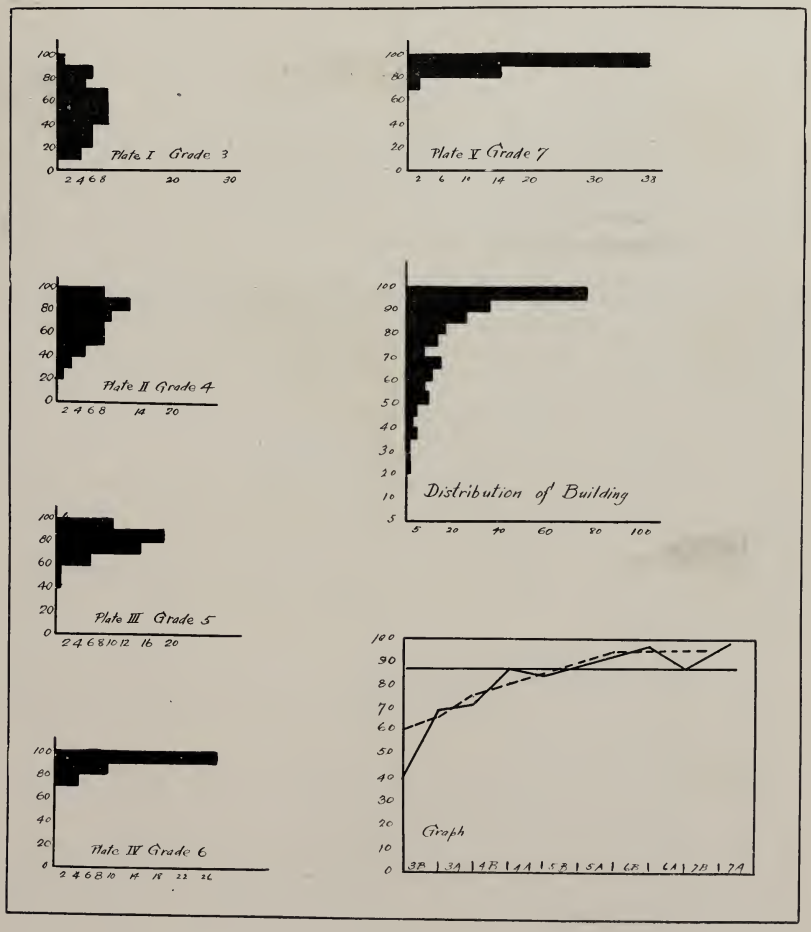

Fig. 56

half-grades, an irregular curve beginning with 37 percent in 3B and ending with 93 percent in 7A. The broken line shows the medians by *grades*, showing a constant upward tendency from third to sixth grades with a slight decline in the seventh grade, due to three or four very poor spellers.

The straight, horizontal line is the median for all the school tested.

The above plates show the distribution of misspelled words in the grades. Ordinates represent percents and abscissas show numbers of pupils.

Plate i. Grade 3 shows that the greater number of children were below 50 percent, ranging from 0 to 90 percent.

Plate ii. Grade 4 shows a range of from 0 to 100 percent, distributed pretty evenly above and below the 50 percent line.

Plate iii. Grade 5 shows a range of from 20 to 100 percent, with the major portion above 60 percent.

Plate iv. Grade 6 shows the range to be from 60 to 100 percent, with a large number from 80 to 100 percent correct.

Plate v. Grade 7 shows an interesting thing in that one very poor speller was alone in being below 40 with a large number between 80 and 100 percent.

Plate vi. Shows the distribution of the entire school tested, the majority of which lie above 60, with the high point between 80 and 85.

The results shown in Fig. 56 were obtained from a test taken March 22 to 25. The same hundred words were used as in the first test and were pronounced to the children and spelled by them (written) without previous warning or review since the February test.

The results were tabulated as in test I, and are expressed in the same way. A comparison of the graph with the corresponding Graph I, in Fig. 55, shows a gain was made in every grade, ranging from 3 percent in 6B to 17 percent in 4A and B. The medians range from 41.5 in 3B to 99.9 in 7A.

Twenty-eight out of 31 pupils in the 7A grade range between 95 and 100 percent, 15 of them having 100 percent.

Plates 1 to 5 show, as in Fig. 55, the distribution of the misspelled words in the grades and Plate 6, that of the building.

It will be noted that the middle point is higher in each plate than in Fig. 55. It is interesting to note the increase in the numbers of pupils ranging from 90 to 100 as the grades go up.

While insufficient work has been done to draw any definite conclusions from this experiment, we feel that the study has been enough to point in certain directions:

(a) There is need of a critical examination of our spelling lists and the methods of teaching them.
(b) There is a lack of ability on the part of our pupils to spell the commoner words.
(c) By studying only misspelled words larger lists can be covered.
(d) Insufficient drill is put on the commoner words that form the basis of our written composition.
(e) Either the misspelled words were not mastered when studied after the test or were quickly forgotten.
(f) There is a constant growth in ability to spell as we go from lower to upper grades.

EXHIBIT II.—EXPERIMENT IN THE USE OF THE AYRES SCALE FOR MEASURING WRITING ABILITY

On February 12, 1914, the first uniform writing test in the South Bend public schools was given to all pupils in grades 2B to 8A inclusive. The test was given by the principals in their respective buildings and consisted in having the pupils write continuously for three minutes this sentence, "Sing a song of sixpence, a pocket full of rye." The quality of the writing was determined by use of the Ayres Scale, the average of the judgments of three individuals being set down on each paper. About sixty teachers were involved in the grading. When this work was completed a tabulation of grade averages for each building and for the system was sent out and the principals instructed in the method of graphing the same. At the same time a standard of achievement for each grade in both speed and quality was proposed to properly direct the efforts of the teaching force.

Three months later, on May 14, a similar test was given. Instructions to the principals at this time were more definite, and designed, if followed closely, to secure the "natural" writing of the pupils tested. This feature of the writing was subsequently checked by comparison with a reproduction test. The papers from the May test were graded as before save that no more than thirty teachers were involved and the third judgment was made in almost all cases by members of the general supervisory force. A comparative tabulation showing the grade averages of the two tests was given out, and certain significant features brought to the notice of the principals. Schools were ranked at this time according to the percentage of pupils equal to or above the proposed standard in both quality and speed.

The May test convinced us of the desirability of somewhat different standards for the grades; standards that might be imposed more reasonably as requirements for at least 75 percent of the pupils. Accordingly in November, 1914, such standards were formulated and given out as "The South Bend Writing Requirements". They were as follows:

GRADE	AYRES QUALITY	SPEED LETTERS PER MINUTE	PERCENT OF PUPILS REQUIRED TO MAKE THESE
3B	40	45	75 percent
3A	40	45	80 percent
4B	40	50	75 percent
4A	40	50	80 percent
5B	50	55	75 percent
5A	50	55	80 percent
6B	50	60	75 percent
6A	50	60	80 percent
7B	60	65	75 percent
7A	60	65	80 percent
8B	60	70	75 percent
8A	60	70	80 percent

On January 14, 1915, a third uniform test in writing was given in all grades from 3B to 8A inclusive. Children were this time asked to write continuously for two minutes the sentence, "When the pie was opened, the birds began to sing." The test was given in every instance by the assistant super-

intendent and all the papers subsequently graded by him. His markings were made subject to correction by the application of a personal coefficient determined from a comparison of his judgment on a hundred selected papers with the judgments of sixteen principals and teachers. Medians were substituted for averages in the tabulation of results and these were compared with medians derived from the first test a year before. (See Fig. 57). The

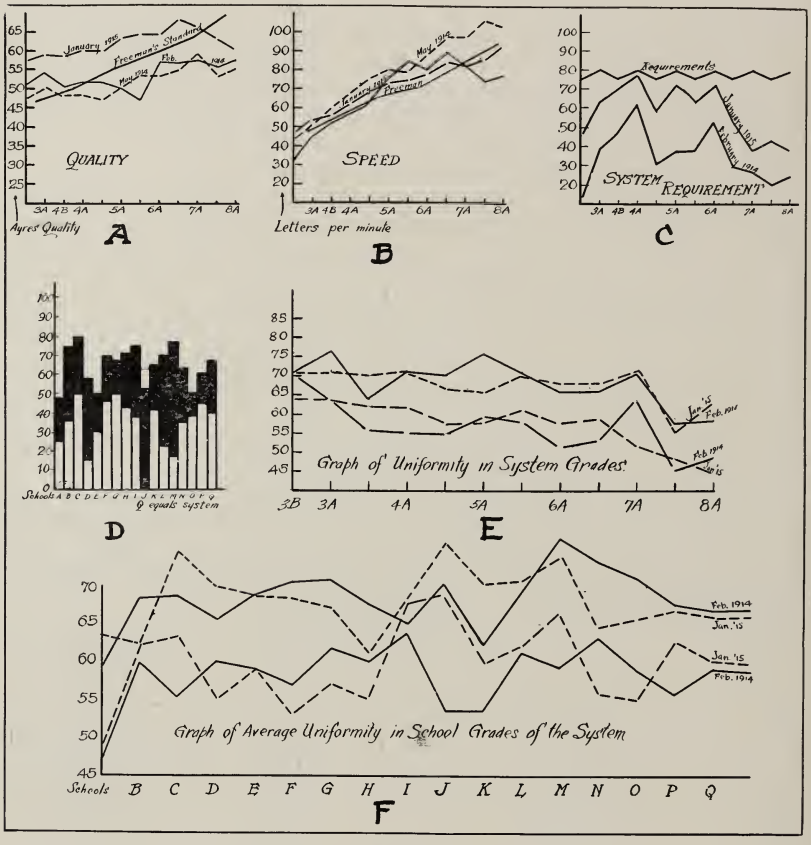

FIG. 57

percentages of pupils equal to or above the "Requirements" in both these tests were also tabulated together. Schools were ranked from the summaries of this tabulation. At this time also a measure was taken of the uniformity of achievement of pupils within each grade. These measures were set down in a third tabulation as "The greatest percentages of pupils within grades whose writing quality falls within two adjacent steps on the Ayres Scale and of those whose writing speed falls within a range of twenty letters per minute." The actual distribution of the grades and of the system were worked out for the benefit of the supervisory force. (See Figs. 58 and 59.)

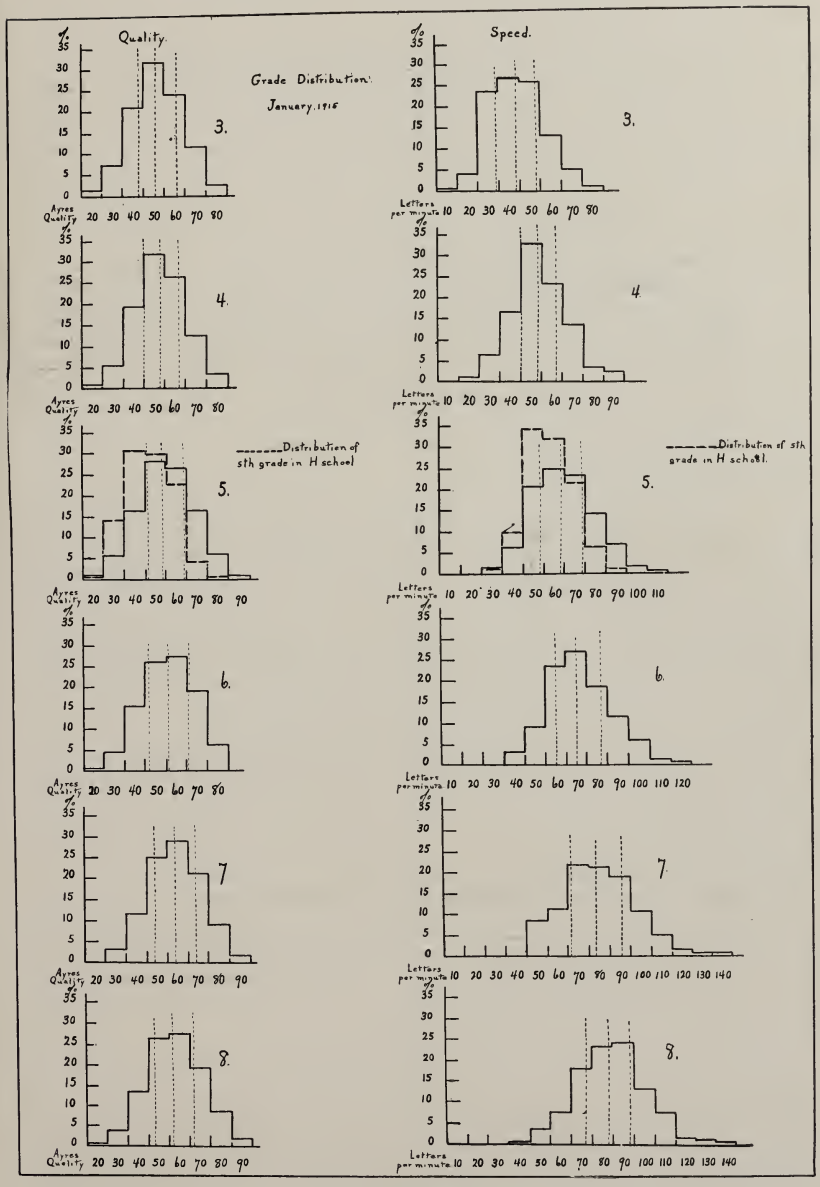
Quality.
Grade Distribution.
January. 1915
3.
4.
5.
6.
7.
8.
Ayres Quality
Distribution of 5th grade in H school
Speed.
Letters per minute
Distribution of 5th grade in H school.

FIG. 58

So much of uniform testing and objective measurement in this subject has brought us to the following conclusions:

1. For the purposes of general supervision the reliability varies inversely as the number of people engaged in the testing and grading.

2. The Ayres Scale is of doubtful value without thoro knowledge of its derivation, study of its samples, and comparative practice in its use. With these it becomes a splendid instrument of effective, economical supervision.

3. Principals and teachers need education in the theory and practice of such testing measurement for two reasons—first, for the sake of their own building and room supervision, and second, for the sake of intelligent appreciation of the purposes of the general supervisory force in their use.

4. Grade medians or averages are not at all vital as compared with "percentages of pupils up to standard" or with "variation within grades".

5. Natural handwriting cannot be guaranteed by any kind of a writing test when small groups are concerned. Ordinary composition work should be used as the basis within a single class or building. Speed can then be ascertained by short-timed tests or timed dictations.

6. Such tests do furnish beyond shadow of question a means of efficient and economical supervision.

Read Graph A thus*: The System grade 3B attained a median quality (Ayres Scale) in the January, 1915, test of 58 (heavy broken line), the 3A of 59, 4B of 59, etc. All grades save grade 8 were above Dr. Freeman's Standard.

Read Graph B in similar way. The figures at the left indicate speed in letters per minute.

Read Graph D thus: School A had 22 percent of its pupils up to South Bend Requirements in February, 1914, and 44 percent in January, 1915. School B had 38 percent in 1914 and 75 percent in 1915 (we ask 75 percent of B grades and 80 percent of A grades to be up to requirements).

Read Graph C thus: System grade 3B in February, 1914, (lower line) had only 17 percent of its members up to requirements. In January, 1915, it had 48 percent up to requirements, etc. Approximation to the oscillating upper line is the present aim.

These graphs show the degree of uniformity of achievement within grades; in graph E by system grades, and in graph F by schools.

Read graph E thus: The System grade 3B (average of schools) in both February, 1914, and January, 1915, tests had 75 percent of its members fall within two consecutive steps on the Ayres Scale in quality and 70 percent and 64 percent respectively fall within a twenty-letter speed range. The actual degree of uniformity of achievement in the 3B grade of the System if school divisions are not regarded is much less.

Read graph F in similar way, except to substitute schools (average of grades) for grades.

Read graph at left thus†: Two percent of third-grade pupils were marked 20 on the Ayres Scale, 7 percent were marked 30, etc. Read graph at the right thus: One percent of third-grade pupils fell within a speed class of 10 to 20 letters per minute; 4 percent within 20 to 30, etc. The dotted lines in the fifth-grade graphs outline the distribution of a single school. This illustrates the value of such graphs for the supervising force.

*Page 218.

†Page 219.

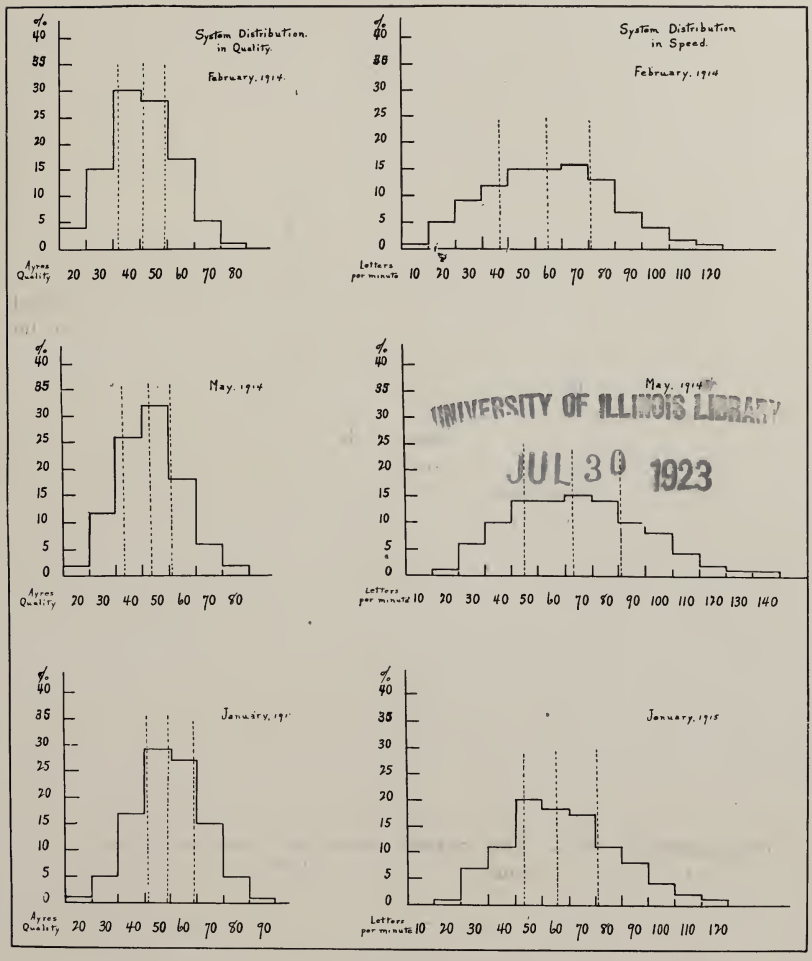

FIG. 59

These graphs show the distribution of the entire system in quality and speed as derived from three different tests. They are read similarly to those in Fig. 58. The dotted vertical lines in these graphs indicate the medians and quartiles.